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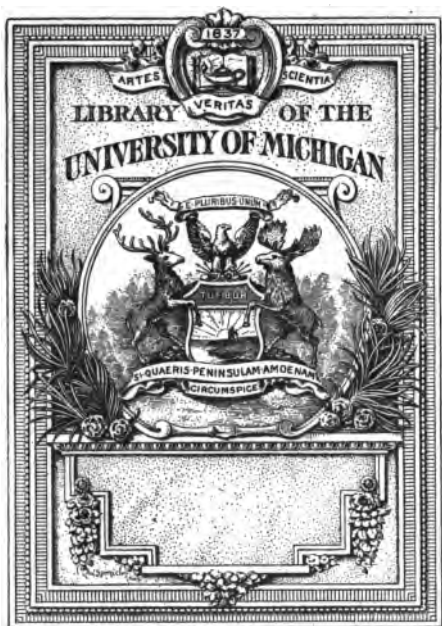
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Additional Notes

on

43416

Australian Cladocera,

raised from Dried Mud.

By

^{Christian}
G. O. Sars.

With 6 Autographic Plates, coloured from Living Specimens.

(Christiania Videnskabs-Selskabs Forhandlinger 1888. No. 7)



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Additional Notes on Australian Cladocera, raised from Dried Mud.

By

G. O. Sars.

(Read at the Meeting held 9th March 1888. — Section for Mathematics and Natural Science).

Introductory.

In two previous papers inserted in this Journal I have partly published the results of a series of experiments instituted with a view to obtain artificially hatched and domesticated Australian fresh-water Entomostraca, the material being parcels of mud collected from lakes and ponds in that remote part of the world, and subsequently sent to Christiania in a dried state. In the first of these papers,¹ published in 1885, I described five different forms of Cladocera, examined in this way during the summer of 1884, whereas the 2nd paper,² published in 1887, was wholly devoted to a more detailed account of one very remarkable Phyllopodous form, examined the preceding summer. It was noticed in the latter paper that, besides other Entomostraca, also several Cladocera had been successfully domesticated in my aquaries during that summer, and these I promised to describe subsequently. In the present paper I propose to give

¹ On some Australian Cladocera, raised from Dried Mud.

² On *Cyclestheria hislopi* (Baird), a new Generic Type of Bivalve Phyllopoda.

descriptions and figures of these additional forms of Cladocera, reserving for a future paper my account of the Copepoda and Ostracoda.

The mud that yielded the several species described in the sequel, was collected by *Mr. Archibald Archer*, during the spring (March) of 1885, at Rockhampton, Queensland, from different localities in the neighbourhood of that town, and kindly sent me, carefully embalmed and marked as to locality. It safely arrived in Christiania on the 29th October same year, and the localities were registered at once in my note-book, the mud being put aside in separate compartments for subsequent experiments.

Owing to the cold weather during the whole spring of the following year, I was obliged to defer commencing my experiments till the last days of May. By that time a number of aquaries of different sizes were ready to receive small parcels of the mud, these parcels having been previously dissolved in pure spring-water. Each aquary was carefully labelled, both as to the locality, from which the mud had been obtained, and as to the date when the hatching operations began.

Although the utmost care was taken in preparing the aquaries, yet in a comparatively small number only did the hatching of the ova contained in the mud, proceed successfully, and hence the greater part had to be removed as unserviceable. But as new aquaries were provided from time to time in place of those rejected, I at length succeeded in getting hatched Entomostraca from every locality registered. Moreover, by allowing the water in some of the aquaries, at the end of the autumn, to evaporate and keeping the bottom-residue in a dried state the winter over, I had the satisfaction the following summer, that of 1887, on again pouring upon it fresh water, to see after some time many of the forms reappearing and now in far greater number, these individuals having evidently been hatched from ova deposited in the mud in the course of the preceding summer.

The results of my experiments during these two summers are on the whole rather more satisfactory than those attained in 1884, a circumstance partly due to the present material being

derived from several localities, whereas that formerly experimented with was taken from but a single place (Gracemere Lagoon), and partly to the additional experience I had acquired in preparing the aquaries.

Of the 11 forms of Cladocera described below, I have been able to identify 6 with species previously noticed, 5 of which are described — though very insufficiently — by *King* in „Papers and Proceedings of the Royal Society of Van Diemens Land,“ Vol. II, Part II, the 6th by Dana, in his great work on the Crustacea of the United States Exploring Expedition. The 5 remaining species I regard as new, and one of these forms represents moreover the type of an interesting new genus.

As with the Cladocera previously described by the author, some of the species included in the present paper show an astonishing resemblance to well-known European forms, and hence a very minute examination has been necessary to make out the distinctive characters. On the other hand there are also several well-marked Australian types, considerably differing from any of the known Northern forms.

The plates accompanying this paper, like those of the two previous ones, have been executed with the utmost care from living specimens. The method is that long since adopted by the author with very satisfactory results, viz., the autography, a particular kind of lithographic chalk having in this case been exclusively employed. Subsequently the plates were printed in colours from my original pencil-drawings.

Description of the Species, with Biological Observations.

Fam. Sididae.

Gen. *Latonopsis*, n.

(see Plate I).

Generic Characters. — General aspect very similar to that of *Latona*, but no dorsal impression between head and trunk, and no distinct fornicate plates laterally above the oral region. Shell-gland very remarkable, tripartite, one of the branches passing across the anterior part of the valves, another straight backwards along the sides, and the third upwards. Antennulæ with flagellum distinctly articulated to the basal part and not geniculate. Antennæ with the upper branch biarticulate, first joint simple, without any lamellar setiferous prolongation of the inner edge. Heart very large, saccular, anteriorly truncate, posteriorly rounded, upper edge concaved.

Remarks. — By the above-given characters, this new genus is readily distinguished from *Latona*, agreeing however in most of the other features very closely with that genus, the Australian representative of which it may be said to constitute.

1. *Latonopsis australis*, n. sp.

(Pl. 1).

Specific Characters. — ♀. Carapace oblong, height and breadth about the same, slightly tapering towards the posterior extremity,

which is obliquely truncate. Free edges of valves densely setose; three of the setæ affixed to the infero-posteal corners excessively elongated and spreading. Posterior branch of shell-gland much larger than anterior, reaching longitudinally beyond the middle of the valves. Head large and thick, obtusely pyramidal, inferior edge oblique and almost straight, not prolonged posteriorly in any distinct rostrum; superior edge gently curved and uniting the dorsal edge of the carapace, without any intervening sinus. Eye, as in *Latona*, located in the dorsal part of the head, at a great distance from the optic ganglion. Ocellus immediately in front of the base of the labrum, very minute. Flagellum of antennulæ about three times as long as the basal part, finely ciliate. Upper branch of antennæ with 12 natatory setæ (5 on first, 7 on second joint), the apical one very elongate; inferior branch with five setæ, one of the apicals almost twice as long as the others. Tail rather small, generally not projected beyond the valves, obtusely conical; anal denticles very minute, 9 on each side; apical claws curved, with 2 strong secondary spines; caudal setæ rather elongate, originating from separate mammillar processes. Body pellucid, without any distinct pigment. Length of female reaching 1.60 mm.

Remarks. — In the above diagnosis I have sought to adduce some characters, which in my judgment should be regarded as merely specific in value. Meanwhile, the present form being the only species as yet known of the genus, it is of course rather difficult to draw up at present a strictly specific diagnosis.

Description. — The length of the largest female specimen examined is 1.60 mm; most of the specimens were however considerably smaller, scarcely exceeding 1.20 mm in length. In its general form the body (see Pl. 1, figs. 1, 2) is very similar to that of *Latona setifera* Müller, being rather narrow oblong and almost as broad as high. On closer examination, however, some well-marked differences are found to exist. Thus, as seen laterally (fig. 1), the head exhibits a more pyramidal shape, its inferior edge running, with an almost straight course, obliquely upwards to the region where the eye is located, whereas in *Latona* it

forms anteriorly a very prominent curve, giving to the head the appearance of being obliquely truncate in front. Posteriorly, the inferior margin of the head terminates with a very slight triangular prominence, on either side of which the antennulæ are seen to project; anteriorly, it joins the dorsal edge by a very sharp curve. The latter edge is slightly convex and not defined from the dorsal edge of the carapace by any intervening impression or sinus, both forming together a quite uninterrupted even curve.

The carapace, or shell, is obliquely oblong in form and, as in most other Cladocera, forms inferiorly two movable flaps or valves, protecting the branchial legs, though more or less widely separate inferiorly and posteriorly (see fig. 2). These valves are comparatively narrow and do not cover the oral parts at the sides, nor are the latter organs, as in *Latona*, protected above by any distinct fornicate plates, interposed laterally between the head and the carapace. The inferior edges of the valves are throughout the greater part of their length well-nigh straight. Anteriorly, they ascend by an even curve, forming in front a rounded flap, to the inner side of which several strong muscular bundles, originating from the sides of the body immediately behind the oral parts, are seen to affix themselves. By the aid of these muscles the valves are moved to a certain extent, being by their contraction approached to each other. Posteriorly, the inferior edges of the valves unite the posterior, by a rather prominent curve; the latter are somewhat oblique, though less so than in *Latona*, and terminate above with a slightly projecting obtuse angle. The dorsal edge of the carapace exhibits a more or less projecting curve in the middle, according to the number of eggs or embryos contained within the dorsal cavity of the shell or matrix. As seen in a dorsal or ventral aspect (fig. 2) the body is somewhat fusiform, the greatest breadth being about in the middle, whence the body successively tapers to either extremity, though somewhat more abruptly in front, the head appearing obtusely conical in form.

The free edges of the valves are fringed, as in *Latona*

throughout their whole length, with numerous slender and movable setæ, three of which on each valve, affixed to the infero-posteal corners, are excessively elongate and generally spread in a radiating manner (see fig. 2). On the inferior edges the setæ are more or less inflexed, whereas on the posterior edges they point backwards, and on the anterior flaps outwards.

As to the sculpture of the shell, nothing more could be detected, save a faint punctation, apparently caused by the numerous transverse pillars connecting the two lamellæ of the valves and defining the complicated network of canals within the substance of the valves, through which the blood circulates.

The so-called shell-gland, located between the lamellæ of either valve, is of very peculiar appearance and wholly unlike that met with in any other known form of Cladocera. It is (see fig. 1) very large and, instead of forming a simple convolute of canals, it is divided into three widely diverging branches, the posterior of which is by far the largest. The inferior branch, properly answering to that commonly found in other Cladocera, crosses the anterior part of the valves and terminates at some distance from the inferior edge; the posterior, on the other hand, runs straight backwards along the sides, close to the line connecting the valves with the upper part of the carapace, and reaches even beyond the middle of their length. Finally, the superior branch is the shortest of the three and passes upwards, almost opposite to the inferior branch. From the point, where the three branches meet, a very delicate and somewhat curved string passes anteriorly to the oral region, its mode of terminating being however very difficult to observe. Of the branches, the upper and lower consist each of a double convolute of clear canals, whereas the posterior would seem to contain three such canals.

The eye, as in *Latona*, is located somewhat dorsally, within the obtusely rounded extremity of the head. It is comparatively of smaller size than in that form, but of quite a similar structure, exhibiting numerous refracting crystalline lenses imbedded in a brownish-red pigment. Owing to its great distance from the optic ganglion, the optic nerves are of quite unusual length,

looking as a pair of slightly flexuous cylindric chords, ascending from the inferior part of the head and joining the eye somewhat posteriorly. Also the ocular muscles are very slender, having their point of affixment close to the inferior face of the head.

The ocellus has the form of a small black spot, located immediately in front of the slight prominence issuing from the ventral side of the head posteriorly.

The antennulæ (fig. 3), affixed to either side of the above-named prominence, appear at first sight very similar to those organs in *Latona*. On closer examination, they are however found to differ materially by the setiform flagellum being distinctly articulated to the basal part in front of the bundle of sensory filaments, whereas in *Latona* the flagellum forms the immediate continuation of that part. It is about three times as long as the basal part, but very slightly curved, not as in *Latona* geniculate, and on both edges provided with delicate cilia, the extremity being drawn out to a fine point.

The antennæ (fig. 4) are very powerful organs of locomotion, the scape, issuing from each side of the head, being exceedingly thick and muscular, with numerous circular folds around its proximal part, indicating its great flexibility in that region. Of the strong muscles moving the scape, the two levatores are very conspicuous; both originate from the dorsal face of the head and converge inferiorly to the base of the scape, the posterior occupying the space between the eye and the heart, the anterior that between the eye and the optic ganglion. At the extremity of the scape, between the insertion of the two branches, a strong spine is affixed to the inner side, and from the outer side, somewhat nearer the base, a much more delicate setiform appendage arises. The branches, as in the other Sididæ, are very dissimilar both as to size and structure, the upper being by far the larger and more abundantly supplied with natatory setæ. This branch is somewhat compressed and composed of but two joints, the outer slightly longer but considerably narrower than the inner. The latter is quite simple, without any trace of the large setiferous dilatation of the inner edge distinguishing the genus *La-*

tona; it bears along the inner edge a simple row of 5 natatory setæ, somewhat increasing in size distally, and has too at the extremity outside a strong spine. The outer joint of this branch is likewise provided at the tip with a spine, though somewhat smaller, and moreover bears 7 natatory setæ, 4 of which issue from the inner edge, the remaining 3 from the tip; of the latter, the upmost is very much elongated. All the setæ are distinctly biarticulate and issue from separate notches in the edge. The lower branch is scarcely more than half as long as the upper and cylindric in form, consisting of 3 joints, the first however very small and imperfectly defined from that succeeding it, which is by far the largest. At the extremity the latter joint bears on the lower side a rather long natatory seta of the same structure as those on the upper branch, and, besides, a strong spine. The last joint is rather small, but very distinctly defined from the preceding; it is provided with 4 natatory setæ, 3 of which originate at the tip, the fourth at a notch in the upper edge. Of the apical setæ the lowermost is very elongated, nearly twice as long as the others.

The oral parts do not seem to differ materially from those in other Sididæ, and also the branchial legs exhibit a very similar structure, as seen from fig. 5, representing one of the 2nd pair, viewed from the anterior side.

The tail (fig. 6), as in *Latona*, is comparatively small, usually not extended beyond the edges of the valves, and forming only a very slight curve with the preceding part of the body. It is obtusely conical in form, with the dorsal edge somewhat flexuous and bulging out in its upper part. The apical claws are strong and curved, each provided with 2 rather elongate secondary spines. The anal denticles are very small, and affixed along the sides of the tail so as scarcely to project beyond the dorsal edge; they are on either side about 9 in number and confined to the exterior part of the tail. The caudal setæ are rather elongate, distinctly biarticulate and densely ciliated; they issue from separate mammilliform carneous processes originating on the dorsal side of the tail, close to the point where it is

connected with the preceding part of the body. Of any dorsal projections in front of the tail for closing the matrix posteriorly, there is no trace. Notwithstanding this, the incubatory cavity, as in other Sididæ, is pretty well defined, partly by the body as a rule lying in close contact with the dorsal part of the carapace posteriorly, partly by a slight inner fold running on either side along a somewhat curved line, more distinctly seen in specimens whose matrix is greatly distended by numerous ova or embryos; this line forms too the demarcation between the dorsal and lateral, or more properly valvular, parts of the carapace.

Inner Organs. — The cephalic ganglion (see fig. 1) is located close to the ventral side of the head, in front of the labrum. As seen laterally it exhibits a somewhat oblique form, the posterior part curving obliquely upwards to join the long commissures encompassing the oesophagus. From its inferior side the two antennular nerves originate, whereas the nerves for the antennæ, as in other Cladocera, are given off from the oesophageal commissures themselves. Immediately in front of the cephalic ganglion the much smaller optic ganglion occurs, being connected with the former by two very short commissures, which may be distinctly traced, when the animal is viewed from below (see fig. 2); in the interspace between the commissures is seen the ocellus imbedded within a clair projection issuing from the cephalic ganglion. The optic nerves, as already noticed, are of quite an extraordinary length and appear, when the animal is viewed from below, pretty well defined from each other throughout their entire length.

The alimentary canal forms a simple cylindrical tube traversing the body, and filled with a light greenish substance. The part contained in the head curves slightly downwards, becoming somewhat more roomy without however forming any true coecal dilatations. The narrow, obliquely ascending oesophagus joins the anterior part of the tube well-nigh at its extremity. Posteriorly the intestinal tube enters the tail, becoming slightly dilated before joining the strongly muscular rectum, which opens near the tip, just above the caudal claws.

The heart, located dorsally in the most anterior part of the trunk, is remarkable for its large size and bag-shaped form. It is somewhat curved, with the upper edge distinctly concave, the anterior extremity being broadly truncate, whereas the posterior is rounded. On either side, about in the middle, a very distinct transverse venous opening occurs, limited by two movable lips, and numerous exceedingly delicate muscular fibres are arranged in the walls of the heart concentrically to this opening.

The ovaries have both as to place and structure the greatest resemblance to those organs in other Sididæ. The ova, when recently deposited into the matrix, exhibit a bright greenish vitelline substance, subsequently divided into large cellular globules.

The whole animal is very pellucid and almost colourless, with no trace of the gorgeous pigment adorning the valves in full-grown specimens of *Latona setifera*.

Biological Observations. — The first specimen of this remarkable form I observed on the 21st June 1886 in a small aquary prepared on the 7th of same month. The said specimen was an adult female, with the matrix greatly distended with numerous embryos in a rather advanced state of development. By the aid of a dipping-tube I succeeded in fishing up the specimen for examination under the microscope, when it at once proved to be a very interesting new form. Being anxious to allow the specimen to deposit the young brood, for this once I confined myself to merely making a slight sketch of the animal, whereupon it was immediately replaced in the aquary. Early the following morning I was placed before the aquary in search of the specimen. But nowhere was any trace to be detected of its existence, and I began to fear, the specimen had not endured the treatment necessary for its preliminary examination and had succumbed along with all its progeny. Some hours later in the day, when examining the aquary in question, I was, however, most agreeably surprised by catching a glimpse of the animal darting about in the water for a moment, and then hiding itself for some time, so as to be quite invisible. The following days I repeatedly watched the animal and observed its peculiar habits, in

which respect it exhibits very considerable resemblance to *Latona setifera* or still more perhaps to *Acantholeberis curvirostris* (Müller). Like both of those Northern species, it is a true limicole form, hiding itself with great dexterity in the loose bottom-deposit, from which it only now and then emerges to make a short trip through the water. This swimming motion is exceedingly rapid and effected by sudden jerks, whence it happens, that the body will often revolve several times before reaching the bottom. Sometimes I have seen it darting up the walls of the aquary, now and again fixing itself for some time together to the very same spot, with the head invariably turned upwards. The elongate diverging setæ of the infero-posteal corners of the valves may indeed be of some service during the movements, being then spread out in a radiating manner. As well known, similar setæ, affixed precisely in the same manner, also occur in the two above mentioned Northern Cladocera, that show such great resemblance in habits with the present form. Moreover, the anomalous position of the eye in this animal, as well as in *Latona setifera*, may, I think, be easily accounted for by the strongly marked burrowing habits of both these forms, the body resting at times for the greater part deeply immersed in the loose mud, with only the dorsal surface more or less uncovered, whence the eye, if located in the usual place, would be comparatively inoperative. Placed under the microscope, the animal generally turns the upper or lower face to the observer, the strongly diverging antennæ preventing it from assuming a lateral position. Only when the antennæ become reflexed and closely appressed along the sides of the valves, is it possible to turn the body so as to get a lateral view of the animal. This reflexion of the antennæ takes place as a rule spontaneously after some time, especially when the quantity of water surrounding the animal is very small. In some cases only does one of the antennæ become reflexed as aforesaid, the other retaining its original extended position (see fig. 1).

After a few days, the specimen had discharged its young brood, and I was much interested in watching the minute and

well-nigh hyaline young darting about in the water in the very same manner as the parent animal, at times, too, hiding themselves in the loose mud. They rapidly increased in size, and after some time had their matrix loaded with eggs; but not one of the specimens attained anything like the size of the first one that appeared, and the number of eggs, or embryos, was much restricted, rarely more than 2 and 4 in each specimen. At the end of the month the specimens seemed to undergo a sort of degeneration, no ova being yet produced; and at the beginning of the next month they successively disappeared, without having developed any so-called winter-eggs, and before any male specimen had made its appearance. At an earlier period I had however secured some specimens with a view to dissection and preserving in spirit.

Occurrence. — The mud from which the above-described form was raised — a rather light clayey bottom-deposit — was, according to the label, taken from a „Water Hole“ at Cattle Station — salt at high tides — 20 miles from Rockhampton. Though several other aquaries were prepared with parcels of the same mud, in none of them did the present form develop. On the other hand, in the same aquary, that yielded this interesting animal, several other Entomostraca also made their appearance, viz., a single female specimen of a beautiful Branchipodidian, apparently belonging to the genus *Streptocephalus* Baird, moreover 3 of the species of *Lynceidæ*, described in this paper, and finally a single specimen of the remarkable Cypridian, *Notocypris cingalensis* Brady.

Fam. Daphnidae.

Gen. *Simocephalus*, Schoedeler.

2. *Simocephalus australiensis* (Dana).

(Pl. 2, figs. 1—5).

Daphnia australiensis, Dana, United States Exploring Expedition, Crustacea II p. 1271, Pl. 89, fig. 4 a—e.

Specific Characters. — ♀. Carapace, as seen laterally, very oblique, subrhomboidal, dorsal edge forming posteriorly a very sharp curve and terminating in a short and broadly obtuse prominence somewhat above the longitudinal axis; ventral edges of valves bulging out a good deal anteriorly and joining with a uniform curve the very oblique posterior edges. Head comparatively small, front subangular, inferior edge well-nigh straight and defined from the short recurved rostrum by an angular notch. Shell obliquely striated, posterior part of dorsal edge strongly denticulate. Eye of usual appearance. Ocellus very small, punctiform. Tail rather broad, supraanal angle obtuse, caudal claws elongate, very slightly curved, armed at the base with a regular series of about 12 strong secondary teeth; anal denticles 9 on either side, rapidly increasing in size distally. Colour light ochraceous, valves with irregular patches of golden yellow. Length of adult female reaching nearly 2 mm.

Remarks. — There can, I think, be but little doubt as to the identity of the present form with that described — though very insufficiently — by Dana under the above name. The apparent dissimilarity as to the form of the carapace and the structure of the antennæ and tail must, I feel sure, be ascribed to a less careful examination, or maybe to some inaccuracy on the part of the lithographer. The species is very nearly related to the Northern form, *S. exspinosus* (Degeer) (= *S. congener* Koch), but on closer comparison it may be readily distinguished by the peculiar oblique form of the carapace and the well-marked, though obtuse, projection of its posterior extremity; likewise too by the broad tail, and more especially by the highly characteristic armature of the caudal claws.

Description. — The length of the largest specimen observed is not fully 2 mm., and hence does not quite attain the size of the European species *S. exspinosus*.

Viewed laterally (Pl. 2, fig. 1), the carapace exhibits a very oblique, almost rhomboidal form, the length somewhat greater than the height. The dorsal edge, throughout the greater part of its length, is but very slightly arched; posteriorly, however, it

suddenly bends downward with a very sharp and abrupt curve, giving this part of the carapace a somewhat gibbous aspect; it terminates at the tip of a broadly rounded projection, located a little above the longitudinal axis of the carapace. The free edges of the valves are slightly concaved anteriorly at the side of the mandibles, below the head however bulging out considerably and forming a rather prominent curve; the inferior edges are nearly straight in the middle, but posteriorly they successively curve upwards, joining the very oblique posterior edges which terminate at the tip of the above-mentioned obtuse projection, without forming any distinct sinus. — The head, as seen laterally, is comparatively small, much narrower than the carapace, and of an oblique triangular form, its dorsal edge exhibiting a perfectly uniform curve, which forms the continuation of the dorsal edge of the carapace. Anteriorly it terminates quite abruptly, the front being at this point produced to a right-angled projection, whence the ventral edge extends posteriorly, with a straight course, to within a short distance from the insertion of the antennulæ; at this point the head juts out as a short acute, somewhat recurved projection or beak, defined from the ventral edge by an angular notch. Viewed from above or below (fig. 2), the head exhibits a rather different form, being very broad and clypeiform. This is caused by the greatly developed fornices, which issue from the sides of the head and cover over the bases of the antennæ. Also in a lateral aspect these fornices admit of being traced with comparative facility as a sharply marked, somewhat flexuous line, running from the front obliquely backwards and joining the carapace at the point where the free edges of the valves take their origin; moreover the line is continued back from this point to the dorsal edge, marking off from the carapace a triangular dorsal area. Just in front of this area there is a very slight impression in the dorsal edge, indicating the limit between the head and the trunk, and this impression is bounded anteriorly by a small projection — the so-called affixing organ. Also the carapace, when viewed dorsally or ven-

trally (fig. 2), exhibits a rather tumid form, rapidly tapering, however, posteriorly to an obtuse point.

The free edges of the valves are strongly inflexed inferiorly and fringed with delicate ciliated setæ, that rarely however project beyond the carapace seen laterally. The inflected edge appears in this aspect of the animal as a slightly sinuated line running along at some distance within the inferior margin (see fig. 1). The dorsal edge of the carapace is smooth, except in its most posterior part, where a dense armature occurs of rather strong appressed denticles, continued to the tip of the posterior projection. As regards the sculpture of the shell, it is that characteristic of the genus, viz., a dense and somewhat irregular transverse striation, the striæ running obliquely backwards, parallel to the posterior edge, often anastomosing with each other, and forming somewhere a dense reticulation.

The eye, located within the most prominent anterior part of the head, is rather small, with a limited number of crystalline lenses, imbedded in a dark brownish pigment. When the animal is viewed from above or below (fig. 2), this organ clearly shows its original duplicity, being deeply incised both anteriorly and posteriorly.

The ocellus is located behind the eye, at some distance from the base of the rostrum; it is very small, well-nigh punctiform, but exhibits under a strong magnifier a somewhat rhomboidal form, similar to that in the European species *S. exspinosus*.

The antennulæ, originating immediately posterior to the rostral projection, are of conical form and tipped with very short sensory filaments; to a knobshaped prominence on their anterior edge, at some distance from the base, a rather elongate, anteriorly pointing bristle is affixed. The outer part of the antennulæ is generally covered at the sides by the anterior part of the valves.

The antennæ are comparatively short, but rather powerful. The scape is cylindrical in form, though somewhat thicker at the base, where it is furnished with a number of circular folds. It bears at the extremity, between the insertion of the branches,

a rather elongate spine, and has moreover on the exterior side of its basal part 2 very delicate sensory bristles (see fig. 2), affixed close together. The branches are nearly equal in size, narrow cylindrical and composed, the lower of 3, the upper of 4 joints. The lower branch is provided with 5 slender biarticulate natatory setæ, 3 of which issue from the tip. The upper branch has only 4 natatory setæ, 3 at the tip and one issuing from the penultimate joint; on the other hand the antepenultimate joint is armed at the extremity, outside, with a small spine. As shown by Schoedeler, the upmost of the three apical setæ of this branch exhibits a structure essentially different from that of the others, being considerably shorter and always curved upwards. On closer examination (see fig. 3) it is found to consist, like the other setæ, of a somewhat thicker basal portion finely ciliated at both edges, and a much narrower terminal part; but the latter is quite smooth and terminates with a chitinous recurved point, or hook. This seta represents a sort of clasping organ, by means of which the animal can cling to aquatic plants or other submerged objects.

The oral parts and legs do not exhibit any essential difference as to structure from those parts in other species of the genus.

The tail (fig. 4) is very broad, lamellar, and as a rule strongly inflexed or doubled upon the preceding part of the body, being thus wholly covered by the valves. It is however very mobile and admits too at times of being exerted far beyond the carapace posteriorly. Its ventral edge exhibits close to the base a sharp curve, but for the rest is quite straight and smooth. The dorsal edge, on the other hand, is irregularly flexuous, its outer part forming along the anal fissure a rather deep sinus, bounded posteriorly by an obtuse angle, anteriorly by a slightly projecting curve bearing the anal denticles. Just posterior to the above-mentioned supraanal angle, it bulges out a little, terminating in a notch, that indicates the limit between the tail and the adjoining part of the body. Immediately below this notch the two rather small caudal setæ originate. The caudal

claws (fig. 5), affixed to a short conical projection issuing from the tip of the tail, are rather elongate and slender, very slightly curved, and armed in their basal part with a regular comb-like series of about 12 spines, the remaining part being but very minutely ciliate along the concaved edge. The anal denticles number on each side from 9 to 12, successively increasing in size toward the extremity of the tail, the outer ones rather large and sharply curved. The part of the body adjoining the tail is considerably curved, the dorsal edge forming two well marked obtuse angles. To the anterior angle is appended a rather long falciform process, curving upwards; and at the posterior angle occurs another somewhat smaller process, generally in close contact with a rather broad, arcuate fold, projecting inwards from the posterior part of the carapace and terminating at the tip of its posterior projection. Both these processes serve to close the incubatory cavity, or matrix, behind, the young being only allowed to escape, when the body is very strongly curved beneath and projected beyond the valves inferiorly.

As to the inner organs, the cylindrical alimentary tube, filled with yellowish or greenish contents, can be at once seen through the shell. It is furnished at the anterior extremity with 2 large incurved coecal appendages (see fig. 2), and posteriorly enters the tail, becoming somewhat dilated before joining the muscular rectum.

The heart, located as usual dorsally in the anterior part of the trunk, is rather small and of a simple oval or pyriform shape, with a single venous opening on each side.

The ovaries, when fully developed, are rather large, covering a great part of the intestinal tube at the sides, and of a dark greenish colour. The ova entering the matrix, are comparatively small and in some cases very numerous (see fig. 1).

The colour of the animal is pale yellowish or ochraceous, with a slight olive tinge in the dorsal part. Moreover, the valves are ornamented with a few irregular patches of golden yellow.

Biological Observations. — The first specimen of this form I observed on the 23rd June 1886, in a small aquary prepared

on the 10th of that month. The specimen was in a rather advanced stage of development and already provided with large greenish ovaries. On the 25th, the ovaries had discharged their contents into the incubatory cavity, now filled with numerous dark greenish globular ova. Before the close of the month the young brood had escaped from the mother, and very soon the latter was again loaded with eggs. It was now fished up, by the aid of the dipping tube, and submitted to a closer examination under the microscope, an accurate coloured drawing being made from the living animal (fig. 1). The young of the 2nd generation rapidly increased in size, and as early as the 4th July some of them had already a few ova in their incubatory cavities. This brood did not, however, by far attain the size of the specimen first observed and they were also considerably paler in colour and much less prolific. It was evident that the conditions of life in the aquary had turned out less favourable to their further growth. For in the course of a few days they diminished considerably in number, and the remaining specimens had a rather morbid appearance, some of them showing an evident intimation to the formation of ephippium. But no true winter-ova were produced, nor could any male specimen be found and by the middle of the month not a trace of their existence remained.

The habits of the animal, as observed in the aquary, were very similar to those of our native species. It is not very active, remaining for some time together affixed dorsally, on the same spot, either to the walls of the aquary or to some aquatic plant, the chief affixing organs being apparently the above described hooked setæ on the antennæ. Only now and again does it make a short run through the water, this natatory motion being in no case continued for any length of time. It always swims on its back, moving about with uniform speed by rapidly repeated strokes of the antennæ; but very soon it again clings to some submerged object, so as generally but with great difficulty to be observed.

Occurrence. — The mud from which I raised this species,

was collected from a fresh-water lagoon, called „Malchi“ — 3 miles from Gracemere. In the same aquary, too, was hatched a specimen of *Diaphanosoma incisum*, described by the author in a previous paper, as also one of the species of Lynceidæ, described below (*Alona levissima*). Dana collected this species in a fresh water pool near Sidney, and it is highly probable that King too has observed the same species in the vicinity of that town.

3. *Simocephalus Elizabethæ*, (King).

(Pl. 2, figs. 6—7).

Daphnia Elizabethæ, King, On some of the species of Daphnidæ found in New South Wales. Papers and Proceedings of the Royal Society of Van Diemens Land. Vol. II, Part II, p. 247, Pl. II (ex parte).

Specific Characters. — ♀. Carapace, as seen laterally, broadly ovate, slightly dilated in its posterior part and terminating with a distinctly defined though obtuse median prominence; superior edge sharply curved posteriorly, inferior edges sinuated in the middle. Head obliquely triangular, front narrowly rounded, with the ventral edge concaved and joining the rostral projection without any intervening notch. Shell obliquely striated, posterior part of dorsal edge finely denticulate. Ocellus having the appearance of an elongate black stripe running obliquely towards the rostrum. Tail narrower than in the preceding species, supraanal angle projecting and finely denticulate, caudal claws smooth, anal denticles on either side about 6. Colour pale chestnut, somewhat darker dorsally, valves with small irregular patches of a bright yellow. Length of adult female 1.54 mm.

Remarks. — Although Mr. King would seem to have confounded several distinct species under this name, I think, at least, that the form figured by him on Pl. II, as the one more generally met with, may be the present species, which should accordingly bear the name proposed by that author. To judge from his description, it is, as above stated, highly probable that he has also observed the preceding species, but regarded it,

however, merely as a variety, and in a subsequent paper, moreover, he describes and figures, under the name of »*D. Elizabethæ* var. *acuti-rostrata*,« another very remarkable form, which, as pointed out also by Mr. Schoedeler¹, undoubtedly represents a very distinct new species. The latter author is however most assuredly wrong in regarding the type-form as identical with the European species *S. vetulus*, having apparently been led to this opinion chiefly by the similar form of the ocellus. In fact the present species exhibits in its general habitus a much greater resemblance to another northern species, the *S. serrulatus* of Koch, from which it however may be readily distinguished, not only by the different form of the ocellus, but also by the rounded front and the absence of denticles on the posterior edges of the valves.

Description. — The length of the adult female does not much exceed $1\frac{1}{2}$ mm, and the species is thus considerably smaller than the preceding.

The carapace, as seen laterally (Pl. 2, fig. 6), is rather broad, irregularly oval in form and somewhat dilated in the posterior part. It terminates, as in the European species *S. serrulatus*, with a well defined triangular prominence, obtuse at the tip, and located exactly in the longitudinal axis. The dorsal edge of the carapace is but slightly arched and posteriorly bends with a sharp curve abruptly down to the posterior projection. The inferior edges of the valves are slightly sinuated in the middle and join the somewhat oblique posterior edge by an even curve. The head, as seen laterally, exhibits a similar oblique triangular form as in the preceding species; but the front is narrowly rounded, not as in that species subangular, and the inferior edge deeply concaved posteriorly, joining the recurved rostral projection without any intervening notch.

The sculpture of the shell is exactly as in the preceding species, and the posterior part of the dorsal edge exhibits a similar armature of small appressed denticles, not continued along

¹ Zur Naturgeschichte der Daphniden. 1877. p. 17.

the posterior edge of the valves, as in *S. serrulatus*. The ventral edges are strongly inflexed and fringed, as in the other species of the genus, with delicate bristles, scarcely however projecting beyond the carapace.

The eye agrees both as to size and position exactly with that in the preceding species.

The ocellus, on the other hand, is highly distinguished by its anomalous form, having the appearance of a narrow, elongate black stripe, pointing obliquely downwards to the rostral projection. As regards this organ, the present species agrees however exactly with the European form *S. vetulus* (Müller).

The antennulæ and the antennæ, as also the oral parts and the legs do not exhibit any essential differences from those parts in the preceding species.

The tail (fig 7), though on the whole exhibiting a structure similar to that in the last species, differs in being comparatively less expanded and in having the supraanal angle considerably more projecting and finely denticulate. Moreover, the caudal claws wholly want the comblike row of secondary denticles present in the preceding species at their base; and the anal denticles are fewer in number, not exceeding 6 or 7, the superior ones being very small.

The colour is pale chestnut or somewhat resembling that in the preceding species, and the valves exhibit likewise some few irregularly scattered patches of a bright yellow tint.

Biological Observations. — The above-described species I first noticed on the 19th June 1886, in a very small aquary, prepared on the 13th of the same month. It was then still rather small, but rapidly increased in size during the following days, and soon became laden with eggs. In the same aquary were hatched several specimens of *Moina propinqua*, described by the author in a previous paper, and, as usual, this form rapidly multiplied, till the aquary at last actually swarmed with the young brood. This having previously proved fatal to the development of other Entomostraca, I thought it better at once to secure the specimen, which accordingly was fished up on the

24th of the same month, and submitted to closer examination, a careful coloured drawing being made from life. The embryos in its matrix were already comparatively advanced in development, exhibiting quite perceptibly as they did all of the limbs and likewise the eyes as yet distinctly separated; the specimen was moreover provided with large greenish coloured ovaries containing material for another brood. — In habits and mode of locomotion this form agrees exactly with the preceding species.

Occurrence. — The mud that yielded the present form, was a small quantity of the same material from which the above-described interesting form of Sididæ, *Latonopsis australis*, had been hatched. Though I apportioned several parcels of this mud among different aquaries, no other specimens of the present species were developed. — According to Mr. King, the species is widely distributed throughout New South Wales, having been found by that author at Sydney, New Town, Paramatta, the Cowpastures, and in the River Karuah, near Stroud, Port Stephens. It may however be questioned whether perhaps some of these localities do not more properly refer to the preceding species.

Fam. Lyncodaphnidae.

Gen. *Macrothrix*, Baird.

4. *Macrothrix spinosa*, King.

(Pl. 3).

Macrothrix spinosa, King, On Australian Entomostracans. I. c. p. 256, Pl. VI. E.

Specific Characters. — Carapace of adult female, as seen laterally, rounded oval, dorsal edge boldly arched in the posterior part, ventral subangulated in front of the middle and obliquely ascending posteriorly, extremity obtusely pointed. Head rather large, subtriangular, semierect, rostral projection slightly prominent, obtuse at the tip. Shell obscurely reticulate, dorsal

edge in adult females quite smooth, ventral edges of valves with a double row of slender spines. Eye rather large; ocellus very small, quadrangular. Antennulæ strapshaped, slightly curved, with about 6 notches along the anterior edge, each with a tuft of very minute hair; a similar tuft behind the apical sensory filaments; those of male much larger, anteriorly with a ciliated seta at some distance from the base. Antennæ about as in *M. laticornis*. Tail with the outer part slightly produced and rounded, dorsal edge sinuated beyond the middle, evenly curved proximally and armed with a single row of strong denticles. Colour pale yellowish. Length of adult female 0.66 mm; of male 0.31 mm.

Remarks. — This form must, I feel sure, be the one that King has noticed under the above name. It is however very insufficiently described by that author, and the characters on which he bases the species, apply equally well to the other known species. The resemblance to the European form, *M. laticornis* (Jurine), is indeed very great, and not till after a most minute examination did I succeed in determining a few distinctive characters. Of these the smooth dorsal edge of the carapace may take the first place.

Description. — The length of the adult female reaches 0.66 mm, and the species is thus somewhat larger than as a rule the European species *M. laticornis*, which undoubtedly is that nearest related to the present form.

The carapace, as seen laterally (Pl. 3, fig. 1), is rounded oval, very little longer than broad, and tapers somewhat posteriorly. The dorsal edge is but slightly arched in the anterior part; posteriorly, however, it bends downward with a rather sharp curve and terminates in a very slight angular projection, located about in the longitudinal axis of the carapace. The valves are comparatively small, and hence a considerable part of the tail remains constantly uncovered, as also the tip of the anterior legs. Their anterior edges are nearly straight and do not wholly cover the mandibles; they join the inferior edges with a very sharp, almost angular curve. The latter edges are

somewhat prominent anterior to the middle, whence they ascend obliquely to the point where the dorsal edge terminates, forming at some distance from this point a very slight curve. The head is comparatively large, semierect, and obliquely triangular in form, with the dorsal edge evenly curved and terminating inferiorly with a somewhat prominent, though obtuse, rostral projection, to which the antennulæ are appended. The ventral edge of the head is somewhat irregularly indented and joins immediately the base of the labrum. There is no dorsal impression between the head and carapace. Above the base of the antennæ a very slight fornicate edge may be distinguished joining the carapace at the point where the free edges of the valves take their origin. — When viewed dorsally the animal appears rather compressed; except when loaded with eggs or embryos; in the latter case (see fig. 2) the dorsal part of the carapace appears rather dilated, with the sides bulging out in the middle.

The shell is obscurely reticulate and exhibits on the dorsal surface of the head a more or less distinct squamous sculpturing, the squamules projecting somewhat posteriorly and thus giving to the dorsal edge a minutely serrulate appearance. The dorsal edge of the carapace, on the other hand, appears, — at least in fully developed female specimens — quite smooth, without any trace of the finely denticulate structure characteristic of the European species *M. laticornis*. The ventral edges of the valves, as in the other species of the genus, are slightly serrate, and moreover armed with slender movable spines, arranged in a double series, those of the inner row being more or less strongly inflexed, the others freely projecting from the valves inferiorly.

The eye, located at some distance from the rostral projection close to the dorsal edge of the head, is rather large, with numerous crystalline lenses imbedded in a dark pigment.

The ocellus, on the other hand, is very small, of irregular quadrangular form, and located close to the apex of the rostral projection.

The antennulæ, as in the other species, are movably inserted to the tip of the rostral projection, from which they, as it were,

hang down. They are rather large, strapshaped, and somewhat curved, successively expanding a little distally. The anterior curved edge exhibits about 6 small notches, each having a few very minute hairs; and a tuft of somewhat longer hair is affixed to an angular projection immediately posterior to the extremity. The latter bears a fascicle of rather large sensory filaments, or rather papillæ, unequal in size. Moreover, to the outer side, at a short distance from the base, occurs a very small and delicate bristle, projecting anteriorly.

The antennæ are rather powerful in structure, with the scape strongly muscular and forming at the base an elbow-like curve, surrounded by numerous circular folds. To the outer side of this part are affixed two delicate bristles, and from the extremity of the scape, between the insertion of the two branches, a slender spine originates. The branches are subequal and about as long as the scape, of a narrow cylindrical form, the lower three, the upper four-jointed. On both branches the last joint is the longest, and tipped with 3 natatory setæ and above the setæ with a strong spine; the preceding joint has on both branches a single natatory seta affixed to the inferior edge distally. On the lower branch, moreover, the 1st joint bears a much stronger seta, generally recurved along the sides of the body, whereas the corresponding joint of the upper branch is without any seta whatever, being armed at the upper edge only with a small spine. All the natatory setæ are finely ciliate and biarticulate, the 1st joint in some of them produced distally into a short spine. On closer examination, too, one of the terminal setæ of the lower branch and two of the upper, are characterised by the 1st joint being finely spinulose at the edges, and not ciliate (see fig. 5). As regards the relative length of the natatory setæ, that of the 1st joint of the lower branch is by far the longest, that of the succeeding joint of same branch is also rather elongate, though much more slender, whereas the others are considerably shorter and about equal in length.

The labrum (see fig. 1) is rather large and produced inferi-

only to a broad triangular prominence, generally covered by the valves.

The mandibles and maxillæ exhibit the usual structure.

As to the structure of the legs, that of the anterior pairs at least would seem on the whole to be on the Lynceid type, the 1st pair being by far the largest and terminating with several strongly denticulated spiniform setæ, partly projecting beyond the valves. The 4th pair is prominently distinguished by the extraordinary size of the vesicular appendage (epipodite), whereas the lamellar appendage (exopodite) is wholly rudimentary. Finally, I have failed to detect any trace of a 5th pair of legs; if notwithstanding they should prove to be present, their condition must in any case be extremely rudimentary.

The tail (fig. 4) is comparatively very small, and is generally strongly inflexed, in such manner that its terminal part remains hidden between the posterior legs. On separating the tail by dissection, this terminal part appears very short and somewhat instricted, with the caudal claws unusually small and feeble; below the latter the dorsal edge forms a somewhat projecting curve, and to each side of this curve a few small spines are affixed, representing the anal denticles. Posterior to the above-mentioned convex part there is a slight sinus, whereas the remaining part of the edge is evenly curved and armed with a single regular series of rather strong denticles, giving it a densely serrate appearance. The caudal setæ are rather elongate and divergent, nearly as long as the tail, biarticulate, with the 1st joint very elongate and quite smooth, the 2nd unusually short and provided with long and delicate cilia on both edges. They originate close together from a common, very slightly projecting rounded prominence, at the upper end of the dorsal edge. — At some distance above this prominence the dorsal part of the body forms a triangular setose projection, which generally lies in close contact with the extremity of a rather broad inner fold running along the dorsal edge of the carapace. More anteriorly the dorsal part of the body exhibits (see fig. 1) in gravid female specimens 4 peculiar mammilliform processes pro-

jecting within the incubatory cavity, the 3 anterior of which are of considerable size. They exhibit a glandular structure and may perhaps serve to secrete some nourishing matter to be absorbed by the embryos during the last period of their development.

Respecting the *inner organs*, the alimentary tube can be at once discerned through the pellucid body by its yellowish colour. It is quite simple, without any loops or circumvolutions. The anterior part, contained within the head, is considerably dilated and curves downwards, but without any trace of coecal appendages. Also the posterior part is sharply curved before entering the tail; the muscular rectum is rather short and opens at the tip of the tail behind the caudal claws.

The heart is rather small, of a rounded oval form and, as usual, provided with a single venous fissure on each side. Just above it, and somewhat in front, is seen a small cup-shaped organ, located immediately within the dorsal edge; it would seem to represent the so-called affixing organ in other Cladocera.

The ovaries are often very large and conspicuous — by reason of their dark greenish colour (see fig. 1), covering at the sides a considerable part of the intestinal tube.

The summer-eggs, when recently discharged into the incubatory cavity, are oval in form and exhibit in the centre a dark greenish cellular vitelline substance. They are often rather numerous, from 10 to 15, distending therefore the dorsal part of the carapace (see fig. 2). Of winter-eggs on the other hand, more than one in each individual (see fig. 3) has never been found; it lies exactly in the middle of the incubatory cavity with its greater diameter parallel to the axis of the shell. As with the forms belonging to the family Daphnidæ (proper), this ovum becomes enveloped with a true ephippium of an oval pyriform shape, and sharply defined from the carapace by its very distinct and coarse reticulate sculpture (see fig. 3). The egg itself is somewhat larger than the summer-eggs, and contains a finely granular opaque substance of a dark brownish colour.

The adult male (fig. 6) is much smaller than the female and

has the carapace somewhat narrower, owing to the dorsal edge being far less arched. It is, moreover, easily distinguished from equal-sized female specimens by the structure of the antennulæ and the 1st pair of legs.

The antennulæ are comparatively much larger than those in the female and somewhat less curved. They are moreover distinguished by the presence of a rather strong finely ciliated seta, affixed to a notch in the anterior edge, at some distance from the base.

The 1st pair of legs are armed with a rather elongate anteriorly curved hook, projecting beyond the inferior edges of the valves.

The testes, easily observed through the pellucid shell, have the form of 2 elongate saccular organs, irregularly instricted at short intervals, and filled with a finely granular whitish content. They partly cover the sides of the intestinal tube and have their outlet at the tip of the tail.

As to colour the body is very pellucid, with a faint grayish or yellowish tinge, changing in adult females to a slightly orange hue. The ephippia are of a rather dark-greyish colour and much less pellucid. Within the body generally are dispersed numerous small oil-globules of a bright reddish colour, more especially along the intestinal tube.

Biological Observations. — I first noticed the presence of this form in the beginning of July 1886, in two of my aquaries, prepared about the middle of the preceding month. The specimens were at that time not very numerous, but in the course of the following days they rapidly increased in number. In another aquary, arranged the 26th June, I likewise found, on my return from an excursion in the beginning of September same year, numerous specimens of this form, both males and females, the latter mostly provided with ephippia, and on examining the bottom-residue of this and the two other aquaries, numerous detached ephippia, each containing a brownish-coloured winter-egg, were detected, evidently deposited in the mud during the course of the summer. In one of the aquaries I allowed the

water to evaporate and kept the bottom-residue in a dried state during the succeeding winter. In May 1887 fresh water was again poured on the mud, and in the course of the following month I had the satisfaction of seeing numerous specimens of this form reappear, evidently hatched from the winter-eggs deposited in the mud the year before. These specimens continued to multiply in the usual manner during the summer, and finally at the approach of the autumn, produced winter-eggs before disappearing. I still keep this aquary for further experiments, and do not doubt, that a new generation of specimens will appear next summer. In regard to habits, the present species closely resembles the European form *M. laticornis*, Jurine. Thus, for example, it is generally found near the bottom, only seldom approaching the surface of the water. It moves rather quickly, by short jerks, the body being generally kept in a somewhat prone attitude. Now and then, too, it will revolve before reaching the bottom. As is generally the case with other Cladocera, the specimens belonging to the summer-generations are more quick in their movements than those hatched in the autumn, and more especially the individuals provided with winter-eggs are considerably less active, apparently owing to the weight of the ephippia. The males are as rule rather more active than the females.

Occurrence. — Although this species was domesticated in as many as 3 of my aquaries, all the individuals were derived from the same parcel of dried mud, collected on the 14th March 1885 from a fresh water Lagoon, called „Crescent Lagoon“, 2 miles from Rockhampton. It was from the same mud I succeeded in raising the interesting Phyllopoде, *Cyclestheria hislopi* (Baird), described in a previous paper, and several other Entomostraca were also derived from this source. — Mr. King met with the present species at the South Creek and in a pond on the road side between Liverpool and Sidney.

Gen. *Ilyocryptus*, G. O. Sars.5. *Ilyocryptus longiremis*, n. sp.

(Pl. 4).

Specific Characters. — Carapace as seen laterally subtriangular, considerably dilated posteriorly, with the anterior part of the dorsal side in adult females strongly vaulted, almost gibbous, inferior and posterior edges of valves passing into each other by an even but very prominent curve, dorsal edge terminating posteriorly as an obtuse angle. Head very small, more or less decumbent, as seen laterally triangular in form, terminating anteriorly with a sharp corner; fornices rather prominent and meeting in front. Carapace in old specimens exhibiting numerous concentric lines of growth, caused by the imperfect exuvation of the shell. Free edges of valves fringed with a dense series of ciliated setæ, those on the posterior edges becoming shorter and having each at some distance from the base a single strong secondary spine. Eye in female considerably remote from the front, in male somewhat larger and nearer the anterior corner. Ocellus considerably smaller than the eye. Antennulæ of female very narrow, cylindrical, of male distinctly dilated in the middle and bearing anteriorly a slender bristle. Antennæ very powerful and more elongate than in other known species, natatory setæ excessively long, especially the terminal ones, but not ciliated. Tail very large, lamellar, dorsal edge sinuated above the middle, outer part armed with a double row of small denticles (about 16 in each row), and also with a lateral row of about 8 slender spines, the upmost somewhat remote from the others; upper part of dorsal edge convex, with a single row of about 8 strong spines; caudal claws elongate, with 2 very small and hair-like secondary denticles at the base; 4 minute denticles on either side between the caudal claws and the lateral series of spines. Colour orange, in old specimens bright reddish. Length of adult female reaching 1.40 mm.

Remarks. — I was at first in some doubt, whether this form perhaps might prove identical with the species recently described

by Mr. Brady from Ceylon under the name of *I. Haleyi*. On closer examination I find however so much that differs from the description and figures given by that author, that at present I do not feel warranted in identifying both, especially as the several species of this genus are so nearly related as to need a much more detailed examination for their identification than that by the above mentioned author. In some respects it resembles rather the European species, *I. agilis* Kurz, but the carapace of the latter species is much more dilated and differs too in the total want of lines of growth, owing to the complete exuvation of the shell in that species.

Description. — The length of old female specimens almost reaches $1\frac{1}{2}$ mm, and this form attains accordingly a somewhat larger size than do the three European species: *I. sordidus* (Lievin), *agilis* Kurz, and *acutifrons* G. O. Sars.

The form of the carapace varies a little with age. In very young specimens it exhibits, as seen laterally, a somewhat regular triangled form, successively widening from before to behind, and is more abruptly truncate posteriorly. In old female specimens (Pl. 4, fig. 1), however, from the considerable dilatation of its upper part, limiting the incubatory cavity, and the successive growth of the valves, it assumes a more oblique form, the anterior part of the dorsal face being considerably vaulted, almost gibbous, and the posterior edges very oblique. In all specimens, the dorsal edge of the carapace terminates posteriorly with an obtuse angle, located considerably above the longitudinal axis of the shell, whereas the inferior and posterior edges of the valves pass into each other by an even, though rather prominent curve. The relation between the height and the length of the carapace is well-nigh the same, or the length very little greater. The head is comparatively very small and, viewed laterally, of triangular form, terminating in front with an acute angle; its inferior edge runs posteriorly, being nearly straight, with only a slight rounded prominence just behind the middle, indicating the place where the antennulæ are affixed. In young specimens, the head extends nearly in the longitudinal axis of the shell, whereas in

old females it becomes considerably decumbent, forming almost a right angle with the carapace. Viewed dorsally or ventrally (fig. 2), the carapace appears somewhat compressed, whereas the head, by reason of the greatly developed fornices, is rather broad compared to its length, clypeiform, and truncate anteriorly.

The outer side of the carapace exhibits in adult specimens a number of sharply marked concentric lines, indicating the successive growth of the carapace. Whereas in young, though ovigerous, specimens, only one or two such lines are present, their number in old specimens may increase up to no less than 9 or 10, all with their centre in the anterior part of the dorsal side, thereby finally assuming a peculiar gibbous aspect (see fig. 1). These lines undoubtedly represent the free edges of as many carapaces of different size, lying one upon the other in an imbricate manner (see fig. 2); and this remarkable structure, also occurring in some other species of the genus, is caused by the imperfect exuvation of the shell, whereof the inner coating only is cast off, the outer chitinous lamella being retained upon the new developing shell. Also on the head similar lines of growth may be traced, lying here however very close together and running parallel to the fornix (see fig. 2).

The free edges of the valves are fringed throughout their whole length with a row of ciliated setæ of somewhat unequal size (see fig. 1). Anteriorly they are rather short and more widely separated, but towards the middle of the inferior edges they become rather elongate and densely crowded, forming there a somewhat spreading fascicle. On the posterior edges they successively become shorter and more spinelike (see fig. 3), having each at some distance from the base a single rather strong secondary spinule, whereas their outer part is still setiform and ciliated. On the edges of the older carapaces, or lines of growth, these marginal setæ are in the present species always found to be worn away; this is however not the case with the European species *I. sordidus*, where they are often found more or less complete, at least on the outer lines. There is no other sculpture to be observed on the carapace, saving the usual delicate punc-

tation, indicating the presence of the numerous transverse pillars connecting the outer lamella of the carapace with the inner soft coating.

The eye is considerably remote from the front, lying near the middle of the inferior edge; it is not very large and exhibits a very limited number of crystalline lenses imbedded in a blackish pigment.

The ocellus is much smaller than the eye, and located at a short distance posterior to that organ.

The antennulæ, originating close together from the ventral part of the head, immediately in front of the labrum, are rather elongate and slender, of a narrow cylindrical form and slightly divergent. They are quite straight and exhibit a short rounded basal joint, the tip provided with the usual fascicle of sensory filaments, two of which project considerably beyond the others.

The antennæ (see fig. 1) are rather powerfully developed, the scape being very thick and muscular, considerably longer than the head, the greater part of which it conceals on viewing the animal from the side (see fig. 1). It has numerous circular folds extending far beyond the middle and giving it great flexibility. On a small tubercle at the outer side occur the two usual delicate bristles, and at the somewhat tapering extremity is observed on each side a slender spine. The branches are rather elongate, though somewhat shorter than the scape, and, as in the other species, of cylindrical form, slightly tapering distally. The lower branch is triarticulate, the upper four-jointed, both provided at the apex with a slender spine and 3 exceedingly long and slender natatory setæ; the lower branch has besides 2 additional somewhat shorter natatory setæ, affixed to the 2 preceding joints, whereas the upper branch exhibits at the outer edge of the 2nd joint a short spine only. All the setæ are distinctly biarticulate, but wholly devoid of the usual delicate cilia.

The oral parts and legs exhibit the structure characteristic of the genus, and may partly be observed through the shell. In particular the large rounded lamellæ (exopodites), affixed to

the two last pair of legs, are very conspicuous in the living animal from their rythmical swinging movements, constituting as they do the chief organs for effecting the renewal of the water inside the valves.

The tail (fig. 4) is enormously developed and very mobile, having the form of a rather broad oblong lamella, slightly tapering towards the tip, to which the very long and slender caudal claws are affixed. The dorsal edge of the tail exhibits above the middle a distinct sinus, indicating the place where the anal orifice is located. The outer part of the edge below this sinus is armed with a double series of rather small denticles, about 16 in each row, and moreover at some distance from the edge, on each side, occurs a lateral series of about 8 much larger slender spines, the upmost invariably removed from the rest by a rather large interval. These lateral rows of spines do not however reach to the above mentioned sinus. Above the latter the dorsal edge is somewhat curved, strongly compressed and furnished with a single median series of 7 or 8 rather large denticles. Moreover, between the tip of the tail and the lateral series of spines, 4 small denticles occur on either side, and at the base of the caudal claws are affixed 2 extremely thin, almost hair-like secondary spines. The caudal setæ, originating from a small knob-like projection where the dorsal edge of the tail terminates, are rather elongate, nearly attaining the length of the tail, and are distinctly biarticulate, with the outer joint beset with scattered cilia.

At some distance above the tail, the dorsal part of the body juts out as a rather elongate conical process, finely hairy along the posterior edge (see fig. 1). This process generally meets the fold extending within the dorsal edge of the carapace, thus closing up the incubatory cavity posteriorly.

The intestinal tube is quite simple, without any circumvolutions. Its anterior part, contained within the head, is but very slightly dilated, whereas the posterior part exhibits, previous to joining the short muscular rectum, a considerable saccular dilatation (see fig. 4).

The heart is rather small, exhibiting the usual structure.

The ovaries are often very large and filled with a clear greenish substance.

The ova recently discharged into the matrix still retain this colour, at least in the centre, but very soon, as the development of the embryo proceeds, assume an orange and finally a reddish tint. Their number is often very great.

The colour of the adult animal varies somewhat, according to age, being at first rather pale yellowish, changing to orange. In older specimens the body often assumes a more or less bright reddish hue, whereas the shell itself generally retains its clear orange colour and pellucidity.

The adult male (fig. 5) is very small, scarcely half the size of the old female, and at first sight somewhat resembles female specimens when quite young and not yet sexually developed. On closer examination, however, it may readily be recognized by a somewhat different form of the carapace, which is more oblique and always exhibits several lines of growth, not yet present in equal-sized female specimens. Moreover, it is easily distinguished by the much larger size of the antennulæ, which are considerably dilated in the middle and provided anteriorly with a very conspicuous bristle, wanting in the female. Finally, the eye is somewhat larger and located nearer the front than is the case in female specimens. It is very remarkable, however, that the 1st pair of legs, which, as is well known, are generally much modified in the males, neither in this nor in any other species of the present genus, exhibit the slightest difference from those in the female, being as in the latter very small and wholly devoid of the usual anteriorly curved claw, a fact perhaps to be accounted for by the slow movements of these animals, making it less necessary for the males to get a faster hold of the females during copulation. The testes may be readily distinguished through the shell as 2 elongate saccular organs extending along the sides of the intestinal tube and filled with an opaque whitish substance; they would appear to have their outlet at the tip of

the tail. — The colour of the male is generally a bright orange, less diluted than in equal-sized female specimens.

Biological Observations. — On the 3rd July 1886 I first noticed the presence of this form in one of my aquaries, prepared on the 11th of the preceding month. By a mere chance I caught a specimen with the dipping tube when searching for other Entomostraca. On closer examination I convinced myself that the aquary contained several specimens of this form; and subsequently too in another aquary prepared somewhat earlier with mud from the same locality, this form was found to have developed. Finally, in a third aquary, prepared on the 9th June with mud from another locality, the same species was hatched and successfully domesticated. It was not easy however to observe the animals in the aquaries, owing to their peculiar habits, mostly hiding, like other species of the genus, in the bottom-deposit. The specimens were then rather small, though partly ovigerous, and had as yet no lines of growth on their carapaces. They however rapidly increased in size and multiplied prodigiously, so that the bottom of these 3 aquaries, after the lapse of some time, literally swarmed with specimens, young and adult. Some of the specimens now showed distinct lines of growth and the number of these lines continued successively to increase, according as the specimens increased in size. On examining one of the aquaries after my return from an excursion in the beginning of September, I still found numerous specimens at the bottom, and now most of them had their shell surrounded by a thick crust of ferruginous matter derived from the bottom-material. This crust having been removed by the aid of a soft brush, the larger specimens exhibited a rather bright reddish colour and showed numerous lines of growth. Some of them had their incubatory cavity filled with ova of a very dark opaque appearance, which indicated their character as true winter-eggs. Of any ephippial structure on the dorsal part of the carapace there was no trace however to be detected, and this I have also found is the case with our indigenous species, the whole carapace serving, after the death of the specimen, as an envelope for the ova.

Of course I was at that time eagerly searching for male specimens, and at last succeeded in detecting a few very small specimens, the fully developed sexual organs showing them to be adult males, one of which is figured on the accompanying plate, fig. 5. In one of the aquaries I allowed the water to evaporate and kept the bottom-residue in a dried state until the following summer, 1887, when fresh water was again poured on it; and in the course of that season I had the satisfaction of seeing numerous examples of the present species reappearing, which had evidently been hatched from winter-eggs deposited in the mud the preceding year. Moreover, I prepared the same summer a small aquary with a parcel of mud from the same locality, kept during the winter in its original dried state; and also in this aquary the same form was hatched and successfully domesticated in the course of the following months.

In its habits the present form closely resembles the other known species of the genus. Like the latter, it is a true limicole form, spending most of its time at the bottom more or less deeply immersed in the loose mud, through which it slowly drags itself by the aid of its antennæ and powerful tail, generally with the belly turned upwards. It is, however, by no means quite devoid of swimming power, as are the other known species of the genus. In fact I have not rarely seen the animal leaving the bottom and moving about freely through the water, though certainly in a very slow and laborious manner, by rapidly repeated strokes of its antennæ. The cause of this clumsy swimming motion is evidently the absolute want of cilia on the natatory setæ, the antennæ themselves being very powerfully developed, but more properly adapted for the usual dragging motion on the bottom.

Occurrence. — The mud from which the greater part of the specimens developed, was collected on the 28th August 1885, from the Gracemere Lagoon, the same locality that yielded the several species of Cladocera described by the author in a previous paper. As mentioned above, I also succeeded in raising this form from another parcel of mud, viz., that from which the

above described species of *Macrothrix* was hatched (Crescent Lagoon).

Fam. Lynceidæ.

Gen. *Dunhevedia*, King.

Generic Characters. — Carapace very tumid, rounded oval in form, narrowly truncate posteriorly; valves widely gaping in the middle, inferior edges densely fringed with delicate ciliated bristles. Head somewhat movable, very broad, clypeiform, produced inferiorly to a sharp rostrum. Eye rather large, with distinctly projecting crystalline lenses; ocellus much smaller and of usual structure. Antennulæ provided anteriorly with a slender bristle, arising from a knob-shaped projection. Antennæ of moderate size, both branches triarticulate, with first joint longer than the two others taken together; lower branch with 4, upper with 3 slender natatory setæ. Labrum produced inferiorly to a large securiform projection. Legs of usual structure. Tail strongly angular beyond the anal orifice, outer part slightly tapering, with numerous small denticles along the dorsal edge; caudal claws unusually short and much curved, with a single secondary denticle at the base. Intestinal tube forming a double loop in the middle.

Remarks. — This genus, proposed by King for two Australian Lynceidæ, must I think be retained, as none of the species can properly be referred to any of the known European genera as yet established, whereas they would both seem to be nearly related. In some respects the genus would appear, so to speak, as intermediate between the genera *Chydorus* and *Pleuroxus* of Baird, differing alike however from both. I have been enabled to examine one of the species, viz.:

6. *Dunhevedia crassa*, King.

(Pl. 5, figs. 1—4).

Dunhevedia crassa, King, On Australian Entomostracans, 1. c. p. 261, Pl. VII. F.

Specific Characters. — ♀. Carapace of adult female, as seen laterally, nearly semicircular, with the dorsal edge boldly arched, ventral nearly straight in the middle and somewhat projecting anteriorly, posterior extremity obtusely truncate, with the inferior corners rounded; a small denticle present in front of the latter. Form of carapace, as seen ventrally, obovate, not constricted in the middle, posterior part tapering. Head nearly as broad as carapace, decumbent, rostrum acute, slightly curved. Eye with 4 large projecting crystalline lenses; ocellus scarcely $\frac{1}{4}$ as large, irregularly quadrangular and placed nearer to the eye than to the tip of the rostrum. Tail with the dorsal angle very pronounced, about in the middle, outer part rather broad, with small tufts of hair at the sides. Colour bright yellowish or corneous. Length of adult female 0.50 mm.

Remarks. — I do not feel any doubt as to the identity of this form with the species described by King under the above name. It agrees comparatively well with the description and figure given by that author, and is easily distinguished from the other species, *D. podagra* King, by the regular obovate form of the carapace, as seen dorsally or ventrally, whereas the latter species has it distinctly constricted in the middle.

Description. — The length of the adult ovigerous female is about half a millimeter.

As to form, the whole animal is considerably tumid and in this respect resembles rather the species of *Chydorus* than those of *Pleuroxus*. The carapace exhibits in a lateral aspect (Pl. 5, fig. 1) a very broad, nearly semicircular form, with the posterior part slightly tapering. The dorsal edge is boldly arched in the middle and anteriorly continued into the dorsal edge of the head, without any intervening sinus; posteriorly it terminates with an obtuse angle. The inferior edges of the valves bulge

out considerably in front; in the middle part however, they are nearly straight and posteriorly ascend a little towards the rounded infero-posteal corners. The posterior part of the carapace is narrowly truncate, with the edges somewhat obliquely rounded. Viewed dorsally or ventrally (fig. 2), the carapace exhibits a regular obovate form, the sides evenly arched and the posterior part tapering to an obtuse point. The head, owing to the greatly developed fornices, is in the latter aspect very broad, scarcely narrower than the carapace, and clypeiform. Viewed laterally (fig. 1), it appears much narrower, with the edge of the fornix somewhat flexuous and separated from the anterior edges of the valves by a deep and rather narrow incision, from the bottom of which the antennæ are seen to project. It is, as in *Chydorus* and *Pleuroxus*, somewhat movable in relation to the carapace and rather decumbent, terminating in an acute, slightly curved rostrum, that does not however project beyond the inferior edges of the valves.

The shell appears quite smooth, without any distinct sculpturing, save the usual minute punctation, and has the inferior edges of the valves fringed with a dense series of very delicate finely ciliated setæ (see fig. 4), and, besides, armed at a short distance from the infero-posteal corners with a single rather strong denticle. On viewing the animal from below (fig. 2), these edges invariably appear wide apart in the middle, and limit a rather large oblong opening leading to the inner cavity of the shell.

The eye, located near the dorsal edge of the head and at a somewhat considerable distance from the rostrum, is of larger size than usual in this family, having too 4 very large and conspicuous crystalline lenses, projecting anteriorly from the dark blackish ocular pigment.

□ The ocellus is much smaller than the eye, scarcely more than $\frac{1}{4}$ as large, and of an irregular quadrangular form; it is located somewhat nearer to the eye than to the tip of the rostrum.

The antennulæ, originating beneath the base of the rostrum,

at a short distance from the ocellus, are rather small, not reaching by far to the tip of the rostrum, and of cylindrical form, or taper somewhat distally. They are furnished anteriorly, a little beyond the middle, with a small knob-shaped projection, bearing a delicate bristle, and at the tip the usual fascicle of sensory filaments originate, some of them much longer than the rest.

The antennæ, as in all other known Lynceidæ, are comparatively small, the scape consisting of two sharply defined segments, very movably jointed together. The branches are about as long as the scape and narrow cylindrical, both composed of but 3 joints, the first by far the largest, longer even than the two others taken together. The upper branch has only 3 natatory setæ, issuing from the tip, whereas the lower exhibits a 4th seta affixed to the 2nd joint. All the setæ are very slender, distinctly biarticulate, and provided with exceedingly delicate cilia.

The labrum projects inferiorly as a very large compressed lamella, well-nigh securiform in shape, and exhibiting posteriorly a sharp corner. The structure of the mandibles and maxillæ I have not closely examined, but they do not seem to present any essential difference from those parts in other Lynceidæ.

The structure of the legs would also appear on the whole to be that characteristic of the family. As usual, those of the first pair are the largest and exhibit anteriorly a sharp geniculate bend, beyond which the anterior edge is beset with small tufts of hair; the terminal spines are however not very strong, less so at least than in most other Lynceidæ. The 2 posterior pairs have, as usual, rather large rounded lamellar appendages (exopodites), by the rythmical motion of which the renewal of the water within the shell is effected.

The tail (fig. 3) exhibits a form deviating considerably from that in any of the known European Lynceidæ. It has a rather clumsy shape and exhibits in the middle a peculiar bend, not found in other species. Hence, the ventral edge is deeply sinuated above the middle, and the opposite part of the dorsal edge forms a strongly projecting angular prominence, located immedi-

ately below the anal orifice. The outer part of the tail beyond this prominence is rather broad, though it gradually tapers towards the obtuse extremity, and has the sides provided with numerous tufts of very short hair; along its dorsal edge there is a double row of very minute denticles, assuming upwards successively the character of fine hairs. The caudal claws are remarkably small and very strongly curved, each having at the base a single secondary denticle. The dorsal edge of the tail exhibits just above the angular prominence a slight sinus, indicating the place, where the anal orifice is located, and bounded above by a very small projection, whence the remaining somewhat flexuous part of the dorsal edge becomes strengthened by a thick chitinous coating. The caudal setæ, issuing from a small knob-like prominence at the upper part of the dorsal edge, are of moderate length, distinctly biarticulate and with the outer joint finely ciliate.

As usual in this family, the tail is connected to the preceding part of the body by a distinct articulation, defined by a very conspicuous transverse chitinous stripe. In front of this articulation, the dorsal part of the body projects a little and as a rule is closely applied against a short inner fold issuing from the posterior part of the dorsal edge of the carapace, thus closing up the incubatory cavity behind.

The intestinal tube exhibits the structure characteristic of the Lynceidæ, its anterior part, contained within the head, being rather dilated, but without any trace of coecal appendages, the remainder, on the other hand, becoming rather narrow and forming in the middle of the body a double loop, often however concealed by the greatly developed ovaries. Before entering the tail, the intestinal tube forms anteriorly a rounded coecal dilatation, whence it immediately joins the short and muscular rectum the outlet of which, as mentioned above, is at some considerable distance from the extremity of the tail.

As regards the structure of the heart and the other inner organs, there is no essential difference to be noted.

Within the incubatory cavity, or matrix, more than two

eggs or embryos are never found at the same time; the latter, as compared with the parent animal, attain a considerable size and always occur in juxtaposition, with the greater diameter parallel to the longitudinal axis of the shell.

The colour of the animal is a bright yellow, changing in the dorsal part to a somewhat darker chestnut tint.

Biological Observations. — I first observed this interesting Lynceid on the 21st July, in the same aquary that yielded the above described remarkable form of *Sididæ*, *Latonopsis australis*. There were at that time several specimens present, all fully developed and with eggs, or embryos, in their matrix. I fished up some for closer examination and preserving in spirit, hoping that the remaining specimens would multiply and thus yield sufficient material for subsequent observations. But they only survived a very short time, probably owing to a sudden change in the temperature that happened to set in during the following days.

As to habits this Lynceid is very active, moving rather rapidly, by sudden jerks, much as does the European form *Alo-nella exigua* Lilljeborg. The movements are however not continued for any length of time, but the animal very soon again clings with its body to some submerged object, more generally to the inner walls of the aquary. When any way disturbed, it will however at once change its place and so rapidly that to catch it with the dipping tube proved a matter of very considerable difficulty.

Occurrence. — As stated above, this form was raised from the same parcel of clayey mud, that yielded two of the above described Cladocera, *Latonopsis australis* and *Simocephalus Elizabethæ* (Water Hole at Cattle Station), though observed in only one of the aquaries prepared with this material. — Mr. King met with the species at Dunheved, the South Creek, and also at Varraville, near Denham Court.

Gen. *Alonella*, G. O. Sars.7. *Alonella diaphana*, (King).

(Pl. 5, figs. 5-7).

Alona diaphana, King, On Australian Entomostracans, l. c. p. 360. Pl. VIII. C.

Specific Characters. — ♀. Carapace much compressed, as seen laterally rounded oval, slightly tapering posteriorly, edges everywhere rounded, without any angle posteriorly either above or below. Head decumbent, hood-like, rostrum obtuse. Shell arcuately striate, striæ rather close together and partly anastomosing, on the anterior part of valves obliquely ascending. Eye of moderate size, crystalline lenses very minute; ocellus somewhat smaller than eye, located about midway between that organ and the tip of the rostrum. Tail rather large, oblong in form, somewhat tapering distally, dorsal edge slightly arched in the outer part and armed with very small, hair-like denticles, supraanal angle slight, apex somewhat produced anteriorly; caudal claws rather strong, with a small secondary denticle at the base. Body very pellucid and almost colourless. Length of adult female 0.49 mm.

Remarks. — I think my identification of this form will also prove correct; at least the general form of the shell agrees rather closely with the figure given by King, and also its great pellucidity would seem to strengthen this opinion. Mr. King refers this species to the genus *Alona* Baird, but I feel persuaded, that both this and the following species ought more properly to be classed within the genus *Alonella*, as long since characterised by the author. The striation of the shell in both differs materially from that in any species of *Alona*, agreeing on the other hand with that characteristic of the former genus.

Description. — The length of the adult female is not quite half a millimeter.

The carapace is rather much compressed, though its dorsal part in ovigerous females becomes somewhat distended by the enclosed eggs or embryos. As seen laterally (Pl. 5, fig. 5), it

exhibits a rounded oval form, with the posterior part somewhat tapering and narrowly rounded off. The dorsal edge is strongly arched in the middle and joins the posterior edges of the valves, without any intervening angle; nor is there any angle between the posterior and inferior edges, both uniting by an even, though rather sharp curve. The inferior edges are nearly straight, or very slightly arcuate, ascending however somewhat in their anterior part to the rounded infero-anteal corners. The head is somewhat decumbent, hood-like, and, as seen laterally, rather broad, with the dorsal edge evenly curved and continuous with that of the carapace; it terminates with an obtuse rostrum, that nearly projects in a line with the inferior edges of the valves. As seen from above (fig. 6), the head exhibits a somewhat triangular form, tapering anteriorly to an obtuse point.

The surface of the shell exhibits a well-marked sculpture, rather difficult however to observe when the animal is wholly submerged in the water. On the other hand, it at once appears very distinct when the shell is floating on the surface, with one of its sides out of the water. The sculpture consists of a rather dense striation, the striæ being somewhat wavy and in some places anastomosing with each other. On the greater part of the carapace they have a longitudinal course, though somewhat arcuate dorsally. On the anterior part of the valves, they however take a rather different course, ascending obliquely, so as partly to run parallel to the anterior edges. In the intervening space there is a partial intersection of the striæ, producing an irregular reticulation. A much similar sculpture is also found in most of the other species and may thus be regarded as a diagnostic mark of the genus. The inferior edges of the valves are fringed with a dense series of rather short and delicate cilia.

The eye is of moderate size, with the crystalline lenses, as usual, rather small and but very slightly projecting.

The ocellus is somewhat smaller than the eye and of irregular quadrangular form; it is located at about equal distance from that organ and the tip of the rostrum.

The antennulæ are of the usual cylindro-conical form and

have, besides the apical sensory filaments, anteriorly and somewhat beyond the middle, a delicate bristle, which however does not originate from any knob-shaped prominence, as in the preceding Lynceid; they slightly project beyond the tip of the rostrum.

The antennæ exhibit the usual structure, and this is likewise the case with the oral parts and with the legs.

The tail (fig. 7) is rather large, of an oblong form, and very slightly tapering in its outer part, which is narrowly truncate, with the anterior corner, bearing the caudal claws, somewhat projecting. The ventral edge is nearly straight and strongly chitinated, whereas the dorsal edge is somewhat arcuate, exhibiting an indistinct angle below the anal orifice, and another somewhat more projecting angle above it. The outer part of the dorsal edge is armed with very small, almost hair-like denticles, arranged in two somewhat irregular rows. The upmost part of this edge, above the supraanal angle is, as usual, strongly chitinated, and exhibits close to the joint connecting the tail with the body, the usual knob-like prominence, bearing the rather small caudal setæ.

The dorsal part of the body in front of the tail projects somewhat, as in other Lynceidæ, to close up the incubatory cavity behind, exhibiting several tufts of fine hair, that indicate the edges of as many imperfectly defined segments.

The inner organs do not exhibit any marked peculiarity in their structure.

As is the case with most other Lynceidæ, more than two eggs, or embryos, are never found in the matrix, and these lie invariably in juxtaposition (see fig. 6).

The whole animal is highly pellucid, and almost colourless, with only a very faint grayish tinge on the body. Also the ovaries and the vitelline matter within the ova are considerably paler than in most other Lynceidæ, and of a very faint greenish tint.

Biological Observations. — The present Lynceid was observed at about the same time as the preceding one and in the same

aquary. There were apparently only a few specimens, of which I secured 3 for closer examination and preserving. As with the preceding form, it was only for a few days I had the opportunity of observing its habits, since the specimens left in the aquary very soon disappeared, without having produced a 2nd generation.

In its motion this form somewhat resembles the species of the genus *Acroperus* Baird, moving about by short jerks and by no means with great activity, the body turning now its dorsal surface upwards, now one of its sides. More generally it rests on the bottom or clings to the walls of the aquary or to any other submerged objects.

Occurrence. — As stated above, the present species was raised from the same parcel of mud as the preceding Lynceid, the material being derived from a Water Hole at Cattle Station — 20 miles from Rockhampton. — Mr. King observed the species in but one locality, a pond near Sydney.

8. *Alonella Karua*, (King).

(Pl. 5, figs. 8-9).

Alona Karua, King, On Australian Entomostracans, l. c. p. 260, Pl. VIII D.

Specific Characters. — ♀. Carapace much compressed, as seen laterally subquadrangular in form, somewhat broader anteriorly, posterior extremity abruptly truncate, inferior edges of valves subangular in the middle. Head depressed, terminating in a rather prominent sharp rostrum. Surface of shell sculptured with well-marked, rather distant striæ, on the posterior part quite straight and somewhat oblique, on the anterior part of the valves arcuate and obliquely ascending. Ocellus smaller than eye and located closer to it than to the tip of the rostrum. Antennulæ slender conical, not reaching to the tip of the rostrum. Tail considerably dilated distally, with the apex broadly

truncate, outer part finely ciliate along the dorsal edge and having a lateral series of very delicate lamellar appressed denticles; supraanal angle very slight; caudal claws of moderate length, with a very minute secondary denticle at the base. Colour pale yellowish brown or corneous. Length of adult female 0,40 mm.

Remarks. — The present Lynceid agrees on the whole, as regards the form of the shell, pretty well with the figure given by King of his *Alona Karua*; and though the tail in his drawing looks somewhat different, I am inclined to regard both these forms as identical. It is undoubtedly congeneric with the preceding species, though easily distinguished alike by the form and the sculpture of the shell.

Description. — The length of the adult female does not exceed 0,40 mm, and hence it is somewhat smaller than the preceding species.

The carapace, as in the latter, is very much compressed, but exhibits in a lateral aspect (Pl. 5, fig. 8) a rather different form, being nearly quadrangular, with the posterior part abruptly truncate and somewhat narrower than the anterior. The dorsal edge has its greatest curvature anterior to the middle and terminates posteriorly with a well-marked angle. Also the infero-posteal corners of the valves are somewhat angular, though less so than the superior corner. The inferior edges project considerably in the middle, their anterior halves ascending abruptly towards the infero-anteal corners. The head is rather depressed, with the dorsal edge but slightly arcuate and continuous with the dorsal edge of the carapace; it terminates in a rather prominent acute rostrum, projecting beyond the inferior edges of the valves.

The surface of the shell is very distinctly sculptured with rather distant and sharply defined striæ, running on the posterior part of the carapace longitudinally, quite straight, and not anastomosing with each other; inferiorly they become successively somewhat oblique, pointing towards the infero-posteal corners. On the anterior part of the valves, the striæ, as in the preceding species, curve obliquely upwards, the most anterior running

parallel to the anterior edges. A partial crossing of the striæ on the intervening space of the valves may also be observed in this species. The inferior edges of the valves are throughout their entire length fringed with a dense row of cilia, somewhat coarser and more elongate than in the preceding species. At the infero-posteal corners occur 2 dentiform projections, which however are so very minute as easily to escape attention.

The eye is rather small and of a structure similar to that in the preceding species.

The ocellus is even a trifle smaller and located nearer to the eye than to the tip of the rostrum.

The antennulæ are rather narrow, conical in form, and, as usual, besides the apical sensory filaments, provided anteriorly with a single delicate bristle at a short distance from the tip; they do not reach to the apex of the rostrum.

The tail (fig. 9) is considerably dilated in its outer part and at the extremity broadly truncate, with the anterior corner projecting less than in the preceding species. The dorsal edge exhibits in its outer half a fine ciliation, and at some distance from the edge a lateral series of about 10 very delicate appressed and somewhat lamellar denticles may be distinguished. There is no trace of any angle below the anal orifice, but above it a very slight angular projection occurs, forming the beginning of a strongly chitinized stripe running along the remainder of the dorsal edge. The caudal claws are relatively a little shorter than in the preceding species and less evenly curved; the secondary denticle at their base is extremely small.

The colour of the animal is pale yellowish brown or corneous, the body being as usual somewhat darker than the shell. The ova contained within the incubatory cavity exhibit in the centre of the bright greenish yolk a rather large orange-coloured oil-vesicle.

Observations. — Of the present form I have had opportunity of observing only a single specimen, an adult ovigerous female, which I accidentally got up in the dipping tube on the 26th July 1886 when searching for other Entomostraca. Although I

subsequently examined the aquary very closely, I did not succeed in detecting any more specimens, and in the course of a few days all life seemed to have become extinct in the aquary. Any observations on the habits of this species I have thus been unable to institute.

Occurrence. — The aquary from which I got this species was the same that yielded the two preceding Lynceidæ; the mud had been collected from a Water Hole at Cattle Station. Mr. King also met with the species in a single locality, the River Karua, near Stroud.

Gen. *Alona*, Baird.

9. *Alona Archeri*, n. sp.

(Pl. 6, figs. 1-4).

Specific Characters. — Carapace of adult female, as seen laterally, oblongo-quadrangular, posterior extremity obtusely rounded, with the upper and lower angles obsolete; inferior edges of valves nearly straight. Head semierect, hooded, terminating in an acute rostrum, projecting beyond the inferior edges of the valves. Carapace of male more regularly quadrangular, inferior edges subangular in front of the middle. Surface of shell sculptured with small depressed pits arranged in longitudinal rows, more distinct in females with winter-eggs. Ocellus much smaller than eye, punctiform. Antennulæ in female rather short dilated in the middle, almost fusiform; in male much larger and projecting considerably beyond the tip of the rostrum. Tail of female rather elongate and narrow, obliquely truncate at the tip, supraanal angle strongly projecting; outer part nearly parallel-sided and armed dorsally with a double row of denticles, the outer ones much larger than the rest and spinulose at the upper edge; a lateral row of 6 extremely delicate spines present; caudal claws much elongated, with a distinct secondary denticle at the base. Tail of male somewhat shorter and less

compressed, wanting dorsal denticles; supraanal angle distinct, extremity transversally truncated; caudal claws shorter than in female and arising from a small knob-like projection nearly in the middle of the truncated extremity; secondary denticle distinct. Colour pale corneous turning to orange, dorsal part of shell, in females with winter-eggs, dark bluish. Length of adult female 0,50 mm, of male 0,34 mm.

Remarks. — This is the largest and finest of 3 new species of *Alona* which I have succeeded in domesticating in my aquaries, and I have much pleasure in naming it in honour of Mr. Robert Archer, to whom I am greatly indebted for his kind assistance in providing me with material for continued experiments in hatching Australian Entomostraca. The present form is readily distinguished from the other known species, as well by the peculiar sculpture of the shell as by the form and armature of the tail.

Description. — The length of the largest female specimens observed reaches about half a millimeter.

The carapace is much compressed and, as seen laterally (Pl. 6, fig. 1) oblongo-quadrangular in form, with the posterior extremity obtusely rounded and but little narrower than the anterior. The dorsal edge is evenly arched, somewhat more in specimens with winter-eggs than in specimens with summer-eggs, and unites the posterior edges of the valves without any distinct intervening angle; nor are the infero-posteal corners distinctly defined, but evenly rounded off. The inferior edges of the valves are throughout the greater part of their length nearly straight; only in the most anterior part do they slightly ascend to the infero-anteal corners, which are likewise rounded off. The head is quite immobile, hood-like and semierect, its dorsal edge forming together with that of the carapace a continuous curve; inferiorly it terminates in a rather prominent acute rostrum, projecting a little below the inferior edges of the valves.

The surface of the shell appears, when the animal is wholly submerged in the water, quite smooth, without any visible sculpturing. But when floating on the surface, the side out of the

water at once reveals a most peculiar and beautiful sculpture, very conspicuous in specimens with winter-eggs (fig. 1). This sculpture consists in numerous impressed pits arranged pretty regularly in longitudinal rows and assuming on the dorsal part of the carapace partly the character of a dense reticulation. A somewhat similar sculpture is observed in another European species of *Alona*, viz., *A. guttata* G. O. Sars, as also in a species of *Chydorus*, *Ch. caelatus* Schödeler. The inferior edges of the valves are, as in most other species of this genus, fringed with a dense row of delicate bristles, or cilia.

The eye is not very large, and the crystalline lenses are few in number and project but little from the pigment.

The ocellus is much smaller than the eye, almost punctiform, and located somewhat nearer to the eye than to the tip of the rostrum.

The antennulæ are comparatively short and thick, almost fusiform in shape, and exhibit, besides the terminal sensory filaments, the usual delicate anteriorly pointing bristle; they do not reach by far to the tip of the rostrum.

The antennæ are by no means powerfully developed, and in structure agree with those in other species of the genus. The branches are somewhat longer than the scape, both of them tri-articulate and subequal in length, the lower with 4, the upper with 3 natatory setæ. Besides, each branch has at the tip a strong spine, and a similar spine is affixed to the outer edge of the upper branch.

The lamellar projection of the labrum is rather large and terminates posteriorly in an almost right-angled corner.

The remaining oral parts and the legs do not exhibit any marked difference in structure from those parts in other species of the genus.

The tail (fig. 2) is rather elongate and narrow, with the supraanal angle projecting considerably. The outer part of the tail, beyond this angle, is nearly parallel-sided, strongly compressed, and somewhat obliquely truncated at the extremity. Along the nearly straight dorsal edge a double series of den-

ticles occurs, the 3 or 4 outmost of which are much larger than the rest and finely spinulose on the upper edge; the denticles do not however extend to the suppraanal angle but are replaced on the edges limiting the anal fissure, by a very minute ciliation. Besides the above mentioned marginal denticles, there is, at some distance from the edge, on either side, a lateral series of about 6 very delicate appressed spines. The caudal claws are very elongate and gently curved, having each at the base a rather strong secondary denticle; they are inserted to a short prominence occupying the anterior corner of the extremity of the tail and defined posteriorly by an angular incision.

The intestinal tube, as usual, forms in the middle part of the body nearly two circumvolutions, or loops, the posterior, however, being not quite perfect, but having more the appearance of a strong S-shaped flexure.

More generally but a single ovum or embryo is found within the incubatory cavity; sometimes however there are two, and in such cases, owing to the trifling width of the matrix, they are generally placed one behind the other, as represented fig. 5 in the following species. This, however, only refers to the summer-eggs. Of winter-eggs more than a single one is never found, and this lies exactly in the middle of the incubatory cavity with its greater diameter parallel to the longitudinal axis of the shell (see fig. 1). The presence of such a winter-egg, easily recognized by its dark opaque colour, is invariably connected with some change in the structure of the dorsal part of the carapace, limiting the incubatory cavity, without however giving rise to the formation of a true ephippium. On the other hand, this part of the carapace becomes very thick and more coarsely sculptured than the rest of the shell, at the same time assuming by degrees a very dark bluish tint, that finally turns to black. In specimens with summer-eggs there is no trace of this peculiar colouring of the dorsal part of the carapace, the whole shell being of a uniform and rather pale yellowish tint. The body of the animal is generally somewhat darker changing to a clear orange.

The adult male (fig. 3) is much smaller than the female, its length reaching only 0.34 mm. The carapace is somewhat more regularly quadrangular, being more distinctly truncated posteriorly, and having the dorsal edge but very slightly arched. The inferior edges of the valves, too, ascend considerably in their anterior part, whereby their edges appear almost angular just anterior to the middle, and, finally, the sculpture of the shell is much less pronounced. There are however some other characteristics, by which the male differs much more markedly from the female. Thus, the antennulæ are much larger and project considerably beyond the tip of the rostrum, the latter appearing comparatively shorter and more obtuse. Moreover, the 1st pair of legs are armed with a powerful, anteriorly curving hook, projected beyond the inferior edges of the valves. Finally, the tail (fig. 4) exhibits a very different aspect, being comparatively shorter and less strongly compressed, as also altogether wanting the dorsal denticles, only the lateral rows of delicate spines being left. The supraanal angle is well marked, as in the female, but the extremity of the tail rather different, being almost transversely truncate and having about in the middle a small knob-like projection, to which the caudal claws are attached; the latter, moreover, occur considerably shorter than in the female, though exhibiting the secondary denticle at the base.

The testes, located on either side of the intestinal tube, the loops of which they partly cover, are divided into several saccular compartments, connected by narrow passages; posteriorly, just at the flexure between the body and tail, the testes contract to a narrow canal running close to the ventral edge of the tail and disembranching at its tip, immediately in front of the caudal claws.

The colour of the male is always much paler than that of the female, the whole body being very pellucid and but faintly tinged with yellowish.

Biological Observations. — Of the present Lynceid I have been enabled to examine numerous specimens, both males and

females, all domesticated in one of my aquaries — a rather large glass jar — prepared on the 15th June 1886. I did not observe their presence in that aquary till after my return from an excursion in September. At that time there were plenty of specimens, the greater part ovigerous. The aquary exhibited a luxurious growth of vegetable matter, *Confervæ* and some other aquatic plants; and this condition would seem to have very much favoured the growth and propagation of this Cladoceran, which undoubtedly, as is also the case with other Lynceidæ, to a great extent feeds upon vegetable matter. The *Alonæ* did not disappear as usual, on the approach of autumn, but continued to live on even till the end of November. During that and the preceding month, most of the female specimens were found to be provided with winter-eggs, and on examining the bottom-deposit, numerous empty carapaces were found, most of them containing a winter-egg. Meanwhile male specimens were by no means rare. Before the close of the year, however, the specimens successively disappeared, and at Christmas there was not a single one yet alive. To convince myself, whether the temporary drying up of the winter-eggs is indispensable to their subsequent development, I did not allow the water to evaporate during the winter but from time to time renewed it, thus keeping the bottom-deposit constantly submerged till the following summer, when the *Algæ* again began to grow. On the 1st June 1887 I first observed several *Alonæ* quite young, and in the course of that month numerous specimens of the present species made their appearance, all evidently hatched from the winter-eggs deposited during the preceding year. The specimens continued to live and propagate throughout the whole of the summer and autumn, but again disappeared at the end of October. I still keep the aquary filled with water, to see if the *Alonæ* will reappear this summer also.

With respect to habits, this animal resembles the other species of the genus, being on the whole a true bottom-form, generally resting on the bottom or clinging to the walls of the aquary or to the *algæ* contained in the latter. Its swimming

motion is anything but active, and affected by rapidly repeated strokes of the antennæ, propelling the animal through the water at quite a uniform rate, the belly generally upwards. The animals seemed in particular to affect the side of the aquary exposed to the rays of the sun. Here they were often found congregated in great numbers clinging to the walls of the aquary or to algæ growing there.

Occurrence. — Also this form was raised from the same parcel of mud, that yielded the preceding species of Lynceidæ, though not developed in the same aquary. Hence the only locality as yet known for the present species is the above mentioned Water Hole at Cattle Station.

11. *Alona lævissima*, n. sp.

(Pl. 6, figs. 5—6).

Specific Characters. — ♀. General habitus very like that of the preceding species. Carapace, as seen laterally, oblongo-quadrangular in form, posterior part truncated, with upper angle distinct, lower rounded; inferior edges of valves nearly straight. Head about as in *A. Archeri*. Surface of shell quite smooth, without any trace of sculpturing. Ocellus nearly as large as eye. Antennulæ rather narrow, reaching almost to the tip of the rostrum. Tail comparatively shorter and broader than in the preceding species, transversally truncated at the tip, supranal angle very slightly projecting; outer part of the dorsal edge armed with a double series of rather small denticles, the outer a trifle larger than the rest, but quite smooth; a lateral series of 5 lamellar appressed denticles present; caudal claws rather strong, with a slender secondary denticle at the base. Colour clear yellowish or corneous. Length of adult female 0.48 mm.

Remarks. — At first I believed this form to be identical with the species described by King under the name of *Alona*

Bairdii. But subsequently I was obliged to give up this opinion, having found it to differ very markedly in several points. Thus, the form of the carapace would seem to differ considerably in both, and the peculiar structure of the natatory setæ on the antennæ, described by King, and likewise found in one of the European species, *Alona spinifera* Schoedeler, does not exist in the present form. Moreover, the species observed by King would seem to attain a much larger size. In its general habitus the present *Alona* very much resembles the preceding species, and may at first sight easily be confounded with it. On closer examination, however, several well marked differences are found to occur, e. g. the much larger size of the ocellus, the deviating form and armature of the tail, and finally the absolute want of any sculpturing of the shell.

Description. — The length of the adult female is but little inferior to that of the preceding species, measuring in the largest specimens 0.48 mm.

The carapace, as seen laterally (Pl. 6, fig. 5), is of oblongo-quadrangular form, with the posterior extremity somewhat more distinctly truncate than in the last species, the upper angle being well marked, though obtuse. The posterior edges of the valves are somewhat oblique and join the inferior edges by a sharp curve; the latter are nearly straight and as usual densely fringed with delicate bristles. The dorsal edge of the carapace, together with that of the head, forms a continuous curve. The head exhibits a form very similar to that of *A. Archeri*, though a little broader, perhaps, as seen laterally.

The surface of the shell, whether in or out of the water, appears quite smooth, without the slightest trace of any sculpturing, save the usual fine punctation.

The eye agrees exactly both as to size and structure with that organ in the preceding species.

The ocellus, on the other hand, is relatively much larger, and but very little smaller than the eye; it exhibits an oblique-quadrangular form, and is located somewhat nearer to that organ than to the tip of the rostrum.

The antennulæ are relatively narrower and more elongate than in *A. Archeri*, reaching well-nigh to the apex of the rostrum, but for the rest exhibit a very similar structure.

The antennæ, oral parts and legs agree exactly with those in the last species.

The tail (fig. 6), on the other hand, exhibits very decided differences. It is relatively shorter and broader, with the extremity transversally truncate, and has the supraanal angle much less projecting than in *A. Archeri*, whence the tail appears about of equal breadth throughout. The outer part of the dorsal edge is armed with a double series of rather small denticles, about 10 in each row. They somewhat increase in size distally, but the outer ones do not by far attain the large size characteristic to *A. Archeri*, nor is there any trace of the secondary spinules distinguishing those denticles in the said species. The caudal claws are rather large, though relatively a little shorter than in *A. Archeri*, and, as in that species, have at the base a slender secondary denticle.

Within the body occur numerous rather large oil-globules, more especially along the intestinal tube, but their colour does not differ from that of the body itself.

The eggs discharged into the incubatory cavity are very frequently two in number, and placed one behind the other, the anterior generally with its longer diameter transverse to the longitudinal axis of the shell (see fig. 5).

The colour of the body is clear yellowish or corneous, the shell itself being very pellucid and considerably paler than the body within. The eggs, as recently discharged into the matrix, have a bluish green colour, with a somewhat lighter circular area in the centre.

Biological Observations. — Of this species I observed during the months of June and July 1886 a few rather small specimens in 2 of my aquaries, prepared that year. The specimens did not however multiply to any greater extent, and subsequently wholly disappeared. The next year (1887) another small aquary was prepared with a parcel of the same mud, kept the winter

over in its original dried state; and in this aquary the conditions seemed to be rather favourable for the growth of the present species, numerous specimens, partly of much larger size than those previously observed, having developed in the course of the summer. All the specimens were however females, propagating in the usual manner by summer-eggs. In August I had to leave Christiania for some time, and on my return the water was wholly evaporated in the aquary. Of course I have not yet been enabled to observe either the winter-eggs, or any male specimen.

Occurrence. — The mud from which I raised this species was collected from a single locality, a fresh water lagoon — called Malchi — 3 miles from Gracemere.

11. *Alona clathrata*, n. sp.

(Pl. 6, figs. 7—10).

Specific Characters. — Carapace of adult female, as seen laterally, rather short, rounded quadrangular in form, posterior extremity truncated, with the upper angle distinct, lower rounded off; inferior edges of valves slightly ascending anteriorly. Head semierect, hood-like, terminating in an acute rostrum projecting beyond the inferior edges of the valves. Carapace of male comparatively narrower, with the dorsal edge much less arched. Surface of shell densely reticulate, the reticulation more especially very distinct in female specimens with winter-eggs. Ocellus nearly as large as the eye. Antennulæ slender conical, almost reaching to the tip of the rostrum, not very much larger in male. Tail of female rather short and broad, apex obliquely truncate, with the posterior corner distinctly angular; supraanal angle projecting; outer part of dorsal edge straight and armed with a double row of very short but strong denticles of equal size; no lateral rows of spines present; caudal claws comparatively rather short, secondary basal denticle exceedingly small.

Tail of male of conical form, tapering to an obtuse point, without any distinct supraanal angle, and wanting dorsal denticles; caudal claws inserted a little behind the apex, rather small, and without any trace of a secondary denticle. Colour light yellowish, dorsal part of carapace in females with winter-eggs somewhat darker. Length of adult female 0.38 mm, of male 0.28 mm.

Remarks. — This species is very nearly related to the European species, *A. parvula* Kurz; but would seem to differ in having a somewhat different sculpture of the shell, as also by certain minor differences in the form and amature of the tail. In general habitus too the animal pretty much resembles the two preceding species, though having a relatively shorter and stouter carapace.

Description. — The length of the adult female does not attain fully 4 mm, and this species is thus somewhat inferior in size to the two preceding ones.

The carapace of the adult female, as seen laterally (Pl. 6, fig. 7), is rather short and stout, nearly as high as it is long, and of a rounded quadrangular form, with the posterior extremity truncated. The dorsal edge is rather boldly arched in the middle and terminates posteriorly with a distinct, though obtuse, angle. The infero-posteal corners, on the other hand, are evenly rounded off. The inferior edges of the valves are throughout the greater part of the length straight, but anteriorly they ascend obliquely to the infero-anteal corners. The head is somewhat depressed, but exhibits on the whole a form very similar to that in the two preceding species, terminating in a rather prominent acute rostrum, projecting a little beyond the inferior edges of the valves.

The surface of the shell, when the animal is wholly submerged in the water, appears quite smooth; but as soon as it rises to the surface, the side out of the water displays a very elegant sculpture, consisting of a dense and rather regular reticulation, the meshes as a rule arranged in longitudinal rows. This beautiful sculpture is more especially very conspicuous in specimens provided with winter-eggs, but may also be traced pretty

distinctly in those having summer-eggs. The inferior edges of the valves exhibit the usual fringe of delicate bristles.

The eye is rather small and of the same structure as in the 2 preceding species.

The ocellus is comparatively large, and but very little, if at all, smaller than the eye, subquadrangular in form and located a trifle nearer to the eye than to the tip of the rostrum.

The antennulæ are of a slender conical form and on the whole agree very nearly in structure with those organs in *A. lævissima*; as in that species they reach almost to the tip of the rostrum.

The tail (fig. 8) differs somewhat in form and armature from the two preceding species. It is comparatively short and broad, more so even than in *A. lævissima*, and has the apex somewhat obliquely truncated, with the posterior corner forming a very distinct angle. The outer part of the dorsal edge is quite straight and armed with a double series of very short but rather strong equal-sized denticles, 8 or 9 in each row. There is no trace of any lateral series of spines, as in the two preceding species. The supraanal angle projects distinctly, and the dorsal edge above it is, as usual, strongly chitinized. The caudal claws are not very large, but exhibit, in common with the dorsal denticles, a rather dark brownish colour; the secondary denticle at their base is exceedingly small.

As in *A. lævissima*, numerous oil-globules are dispersed within the body, exhibiting, however, in this species a very conspicuous orange hue.

The colour of the animal is pale yellowish or corneous, the dorsal part of the shell being somewhat darker in specimens provided with winter-eggs, though never assuming such a black colour as in *A. Archeri*.

The adult male (fig. 9) is, as usual, much smaller than the female, scarcely attaining a length of 0.30 mm, and is distinguished by the carapace being considerably narrower, owing to the much less arcuate dorsal edge. As in other species it is, besides, easily recognized by the strong, dark brownish-coloured

hook on the first pair of legs, as also by the very different form of the tail. In the latter respect it is also very markedly distinguished from the male of *A. Archeri*, described above.

The antennulæ, on the other hand, do not materially differ from those organs in the female, since they are not very much larger and scarcely projecting beyond the tip of the rostrum.

The tail (fig. 10), as stated above, looks very different from that in the female. It is considerably narrower, almost conical in form, and tapers gradually to an obtuse point. The dorsal edge is in its upper part somewhat irregularly arched, but does not exhibit any distinct supraanal angle; nor is there any trace of denticles to be seen on the outer part of the dorsal edge. The caudal claws are very small and without the slightest trace of the basal secondary denticle; moreover their place seems rather anomalous, being inserted just behind the obtuse extremity of the tail, close to its dorsal edge.

The testes exhibit a structure very similar to that described above in the male of *A. Archeri*, and have, as in that species, their outlet at the tip of the tail, in front of the caudal claws.

The colour of the male is about the same as that of the female, with this difference, however, that the whole tail has a dark brownish tinge.

Observations. — I first observed this species in the beginning of September 1886, on returning from an excursion. They were present in only one of my aquaries, prepared on the 9th June same year, but in great profusion, both males and females, the latter for the greater part with winter-eggs. In its habits this species does not in any way differ from the two preceding ones.

Occurrence. — The mud that yielded that species was taken according to the label on the 14th March 1885, from the Crescent Lagoon — 2 miles from Rockhampton, the same locality whence several other interesting Entomostraca were raised, among others the above-described species of *Macrothrix*.

The following is a systematic list of all the forms of Cladocera I have as yet succeeded in raising from dried Australian mud, including those described in my previous paper: —

Fam. Sididae.

1. *Diaphanosoma excisum*, G. O. Sars.
2. *Latonopsis australis*, n. gen. & sp.

Fam. Daphnidae.

3. *Daphnia Lumholtzii*, G. O. Sars.
4. *Ceriodaphnia cornuta*, G. O. Sars.
5. *Moina propinqua*, G. O. Sars.
6. *Simocephalus australiensis* (Dana).
7. — *Elizabethæ* (King).

Fam. Lyncodaphnidae.

8. *Macrothrix spinosa*, King.
9. *Ilyocryptus longiremis*, n. sp.

Fam. Lynceidae.

10. *Dunhevedia crassa*, King.
11. *Alonella diaphana*, (King).
12. — *Karua*, (King).
13. *Leydigia australis*, G. O. Sars.
14. *Alona Archeri*, n. sp.
15. — *lævissima*, n. sp.
16. — *clathrata*, n. sp.

Before closing this paper I should wish to give my opinion relative to the species of Cladocera described by King in his two subsequent papers, inserted in „Papers and Proceedings of

the Royal Society of Van Diemens Land", Vol. II, Part II. It may be observed that some of these species, viz., those belonging to the family Daphnidæ (proper) have been already mentioned, and some of the figures copied, by Mr. Schoedeler in his paper „Zur Naturgeschichte der Daphninen. Beiträge zur Kenntniss der systematischen Angehörigkeit der Daphninen.“ Berlin 1877. I do not however fully agree with that author as to his identification of some of the species.

The species enumerated by King are in all 18, viz.: —

1. *Daphnia carinata*, King.

This form is, I think, evidently different from any of the European species, though perhaps, as also suggested by Schoedeler, more nearly related to *Daphnia magna* Straus (= *D. Schaefferi* Baird).

Besides the typical form Mr. King figures 4 varieties, two of which are separately named as var. *gravis* and var. *cephalata*. I think Mr. Schoedeler is right in regarding the two latter varieties at least as more properly distinct species. In none of these supposed varieties is there however any approach to the very remarkable form of the head in *D. Lumholtzii*, described by the author in a previous paper.

2. *Daphnia Elizabethæ*, King.

Gen. *Simocephalus*. See above.

The supposition advanced by Mr. Schoedeler, that this form is identical with the European species *S. vetulus* (Müller), I have shown to be evidently wrong. On the other hand, there can be little doubt, that he is quite right in holding the form, described by King as var. *acuti-rostrata*, to be a distinct species, though I believe this species should more properly be named *S. acuti-rostratus* and not, as proposed by Mr. Schoedeler, *S. paradoxus*.

3. *Daphnia honorata*, King.

Gen. *Ceriodaphnia*. This species would seem to be nearest related to the European species *C. reticulata* (Jurine), though undoubtedly distinct. It is also different from the species described by the author in a previous paper as *C. cornuta*.

4. *Moina lemnæ*, King.

This is certainly not a *Moina*. I feel tolerably convinced that it more properly ought to be referred to the genus *Latonura* Lilljeberg, belonging to the family *Lyncodaphnidae*.

5. *Moina Macleayii*, King.

As pointed out by Mr. Schoedeler, this is a very distinct species, exhibiting certain most anomalous characters. I believe it is very closely allied to, if not identical with, the species recently described by Mr. Brady from Ceylon under the name of *Moina submucronata*. Through the kindness of that author I have been enabled to examine a few of his specimens, and find this form to differ in several respects so materially from the known European species of *Moina*, as also from the Australian species, *M. propinqua*, described by the present author in a previous paper, that I am inclined to regard it as belonging to a distinct new genus, for which I would propose the name of *Paramoina*. To this genus also the form described by King should be referred.

6. *Daphnia mucronata*, Müller.

Gen. *Scapholeberis*. Though this form certainly belongs to the same genus as *Daphnia mucronata* Müller, I cannot agree with Mr. King and Mr. Schoedeler in regarding it as identical with the above-named European species. According to the figure given by King, it differs among other things rather markedly in the much smaller and differently formed head. I would propose for the species the name *Scapholeberis Kingii*.

7. *Macrothrix spinosa*, King.

See above.

8. *Eurycercus Cunninghami*, King.

Mr. King is most certainly wrong in regarding this form as an *Eurycercus*. There is in fact no similarity whatever. The sculpture of the shell somewhat resembles that characteristic of the genus *Alonella*, whereas the very broad, obliquely truncate carapace reminds one of the genus *Leydigia*. It would seem however in other respects to differ essentially from both of these genera, and may more properly be regarded as the type of a distinct new genus, for which the name of *Kingia* might be adopted.

9. *Eurycercus spinosus*, King.

Perhaps congeneric with the last-named species; very different from *Eurycercus*.

10. *Chydorus augustus*, King.

Nearest related perhaps to the European species *C. globosus* Baird, though undoubtedly distinct.

11. *Chydorus Leonardi*, King.

This form would seem, both as regards its small size and the form of the tail, to come very near to the well-known European species *C. sphaericus* (Müller).

12. *Alona Bairdii*, King.

Though undoubtedly belonging to the genus *Alona*, this species would seem to differ from any of the European species, as also from those described in the present paper.

13. *Alona pulchella*, King.

I am somewhat in doubt whether this be a true *Alona*, as the sculpture of the shell would seem somewhat different, the striae running rather obliquely, in which respect it appears rather to agree with the genus *Alonella*.

14. *Alona diaphana*, King.

Gen. *Alonella*. See above.

15. *Alona Karua*, King.

Gen. *Alonella*. See above.

16. *Alona mascula*, King.

This form is perhaps the male of *Alona Bairdii*, King.

17. *Dunhevedia crassa*, King.

See above.

18. *Dunhevedia podagra*, King.

Undoubtedly congeneric with the last species, and apparently specifically distinct.

Explanation of the Plates.

Plate 1.

Latonopsis australis, n. gen. & sp.

- Fig. 1. Adult ovigerous female, viewed from left side; magnified 74 diameters. — The right antenna is extended, the left reflexed and closely appressed along the shell, an attitude often assumed by the animal, when examined under the microscope in a small quantity of water.
- 2. Another female specimen, from below, with both antennæ extended and the setæ of the infero-posteal corners of the valves exposed; magnified 56 diameters.
 - 3. One of the antennulæ, magnified 89 diameters.
 - 4. One of the antennæ; same enlargement.
 - 5. A leg of 2nd pair, expanded and viewed from the anterior side.
 - 6. Tail with adjoining part of body, viewed from left side.

Plate 2.

Figs. 1—5. *Simocephalus australiensis*, (Dana).

- Fig. 1. Adult ovigerous female, viewed from left side; magnified 46 diameters.
- 2. Anterior part of body of another specimen, from below; same enlargement.

Fig. 3. The upmost of the terminal setæ from the upper branch of an antenna, magnified 220 diameters.

- 4. Tail together with the adjoining part of the body, viewed from left side; magnified 89 diameters.
- 5. One of the caudal claws, magnified 220 diameters.

Figs. 6—7. *Simocephalus Elizabethæ*, (King).

- 6. Adult female with greatly developed ovaries and the matrix filled with embryos, from right side; magnified 56 diameters.
- 7. Tail with adjoining part of body, from right side; magnified 89 diameters.

Plate 3.

Macrothrix spinosa, King.

Fig. 1. Adult female with greatly developed ovaries and the matrix empty, viewed from left side; magnified 110 diameters.

- 2. Another female specimen with the matrix distended by numerous eggs, from above; same enlargement.
- 3. Female specimen with ephippium, from right side; magnified 138 diameters.
- 4. Tail with adjoining part of body, from left side; magnified 220 diameters.
- 5. One of the terminal setæ of an antenna; same enlargement.
- 6. Adult male viewed from right side; magnified 138 diameters.

Plate 4.

Ilyocryptus longiremis, n. sp.

Fig. 1. Old female specimen with numerous embryos within the matrix, viewed from left side; magnified 74 diameters.

- 2. Same form below.

- Fig. 3. Part of posterior edge of carapace, showing the structure of the marginal setæ; magnified 120 diameters.
- 4. Tail with adjoining part of body, from left side; same enlargement.
 - 5. Adult male, viewed from right side; magnified 138 diameters.

Plate 5.

Figs. 1—4. *Dunhevedia crassa*, King.

- Fig. 1. Adult gravid female, viewed from left side; magnified 138 diameters.
- 2. Same from below.
 - 3. Tail with adjoining part of body, from left side; magnified 220 diameters.
 - 4. Part of ventral edge of a valve, showing the structure of the marginal bristles; same enlargement.

Figs. 5—7. *Alonella diaphana*, (King).

- 5. Adult gravid female, viewed from left side; magnified 138 diameters.
- 6. Same, from above.
- 7. Tail with adjoining part of body, from left side, magnified 220 diameters.

Figs. 8—9. *Alonella Karua*, (King).

- 8. Adult ovigerous female, viewed from left side; magnified 138 diameters.
- 9. Tail with adjoining part of body, from left side; magnified 220 diameters.

Plate 6.

Figs. 1—4. *Alona Archeri*, n. sp.

- Fig. 1. Adult female with winter-egg, viewed from left side; magnified 138 diameters.

- Fig. 2. Tail from left side, magnified 300 diameters.
- 3. Adult male, viewed from right side; magnified 176 diameters.
 - 4. Tail of same, from right side; magnified 300 diameters.

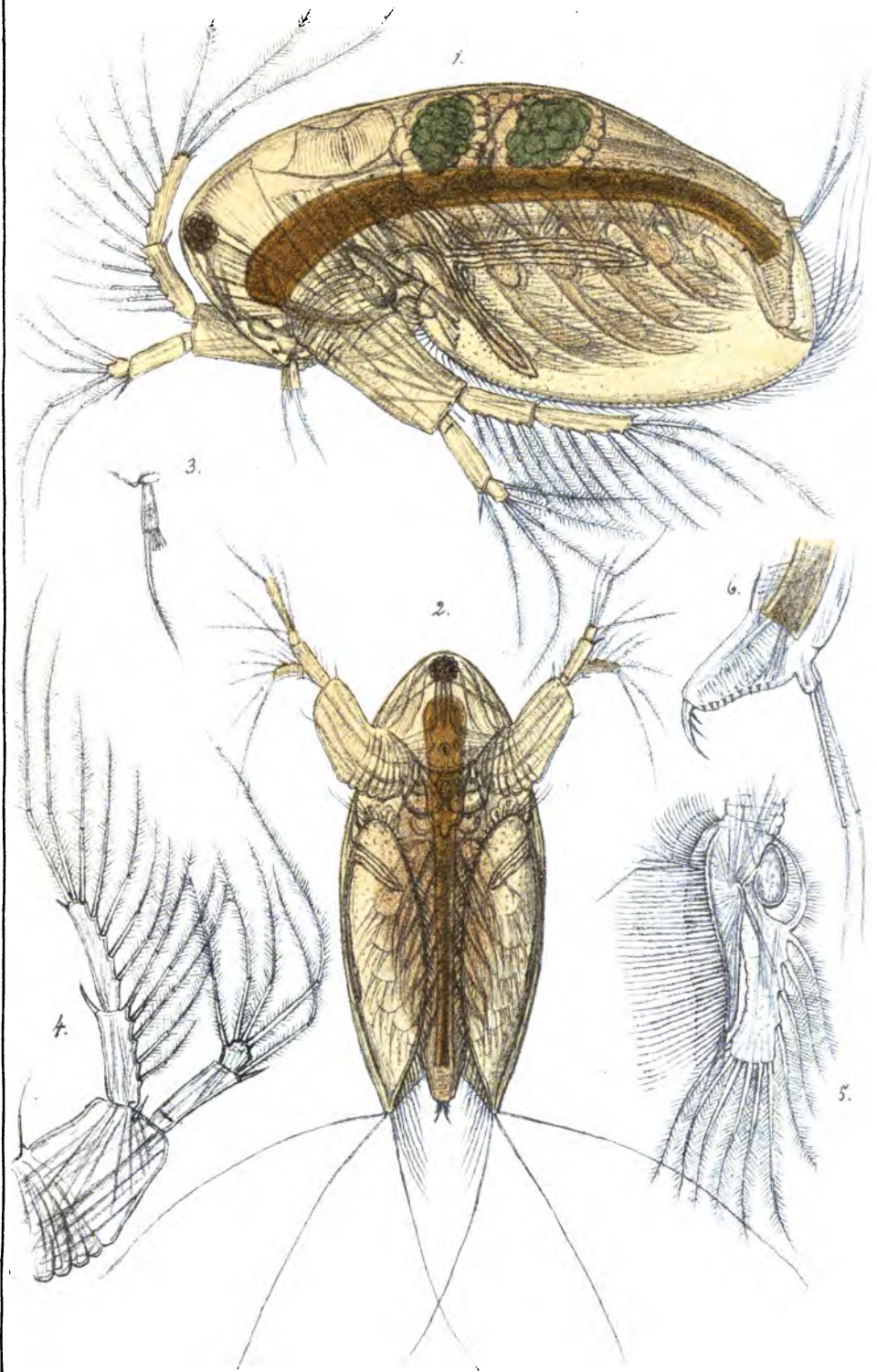
Figs. 5—6. *Alona lævissima*, n. sp.

- 5. Adult ovigerous female, viewed from left side; magnified 138 diameters.
- 6. Tail from left side, magnified 300 diameters.

Figs. 7—10. *Alona clathrata*, n. sp.

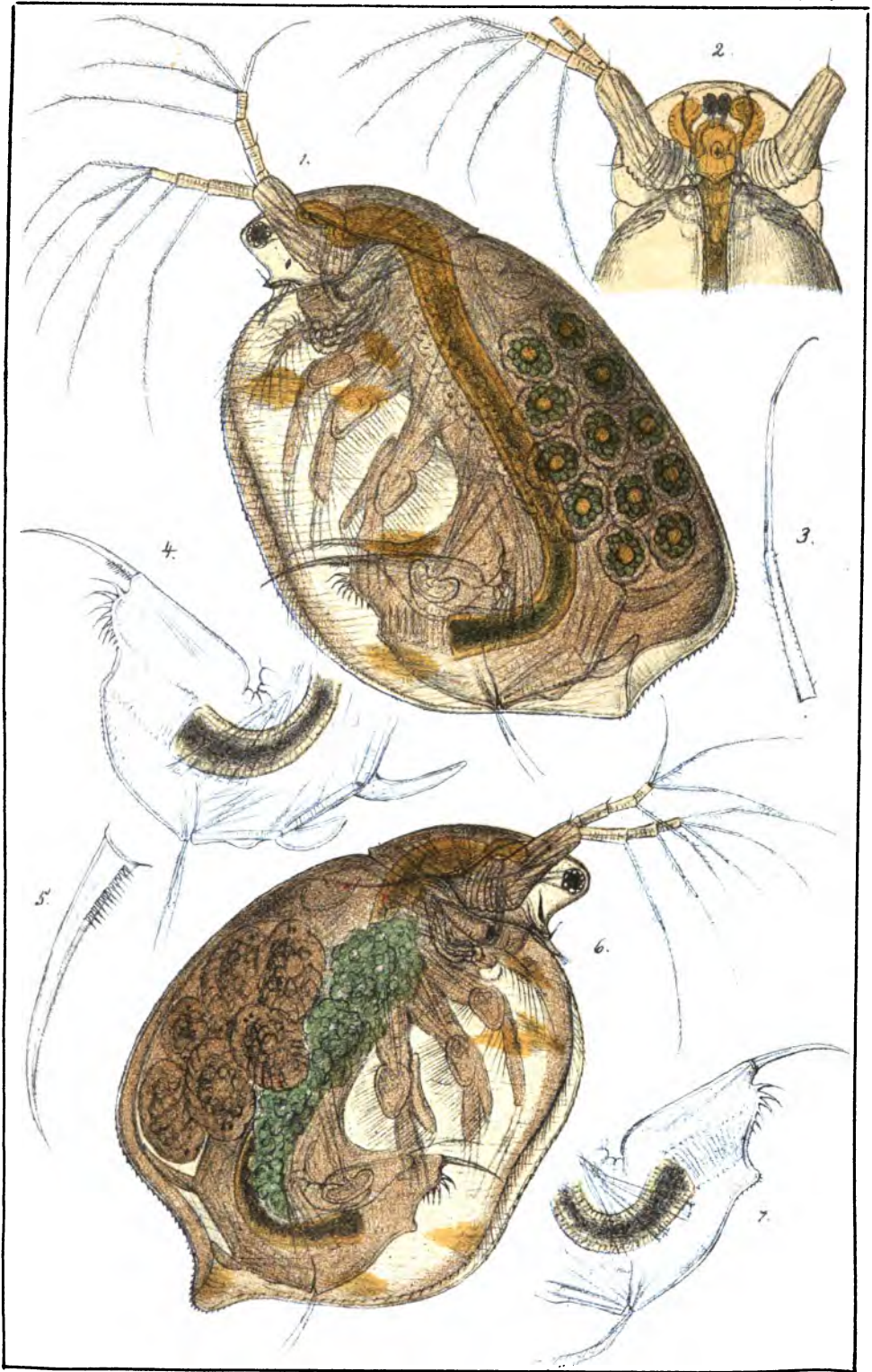
- 7. Adult female with winter-egg, viewed from left side; magnified 138 diameters.
- 8. Tail from left side, magnified 300 diameters.
- 9. Adult male, viewed from right side; magnified 176 diameters.
- 10. Tail of same, from right side; magnified 300 diameters.





G.O. Sars autogr.

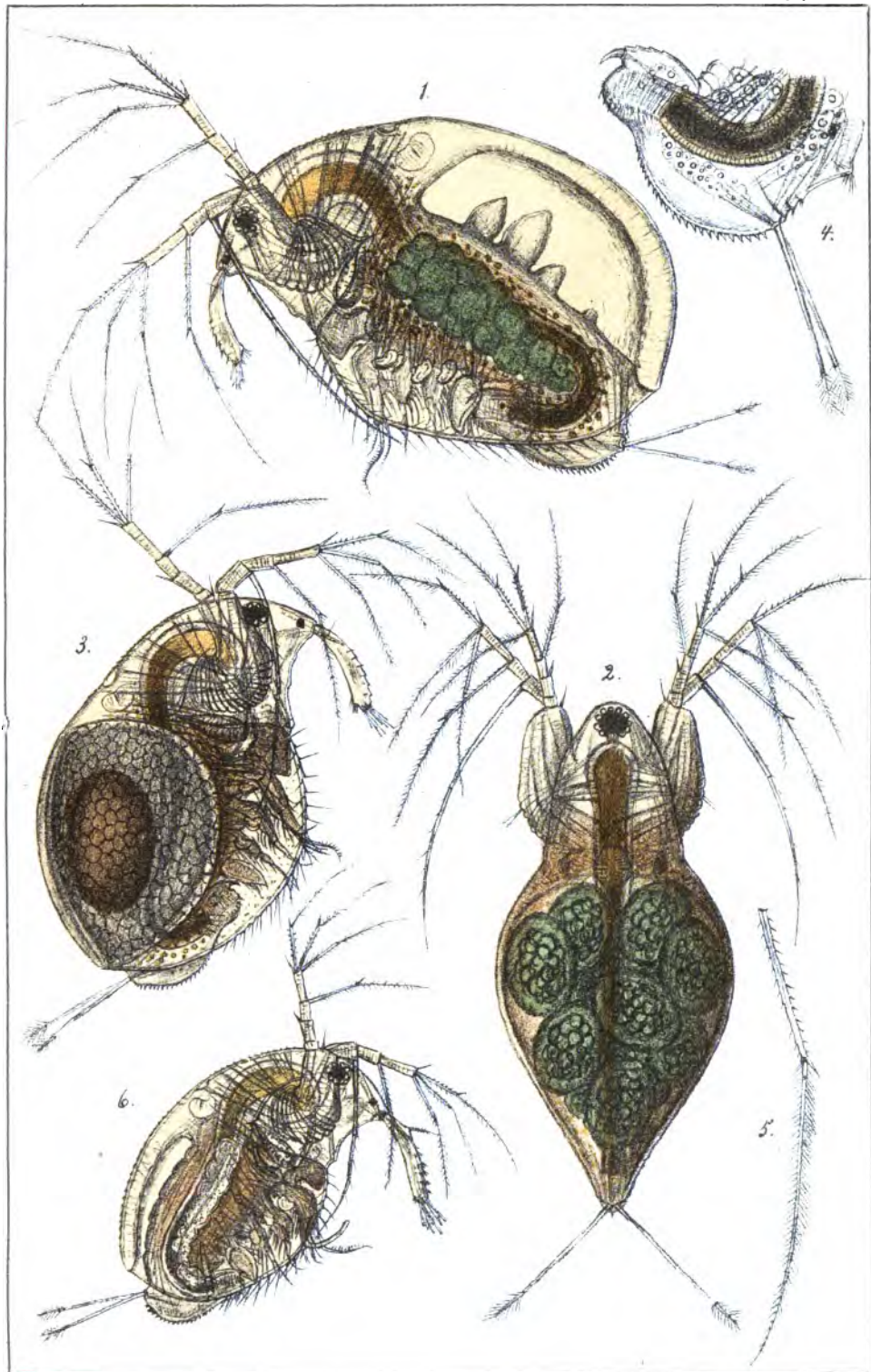
Latonopsis australis,
nov. gen. & sp.



G.O. Sars auctogr.

Fig. 1-5, *Simocephalus australiensis*, (Dana).

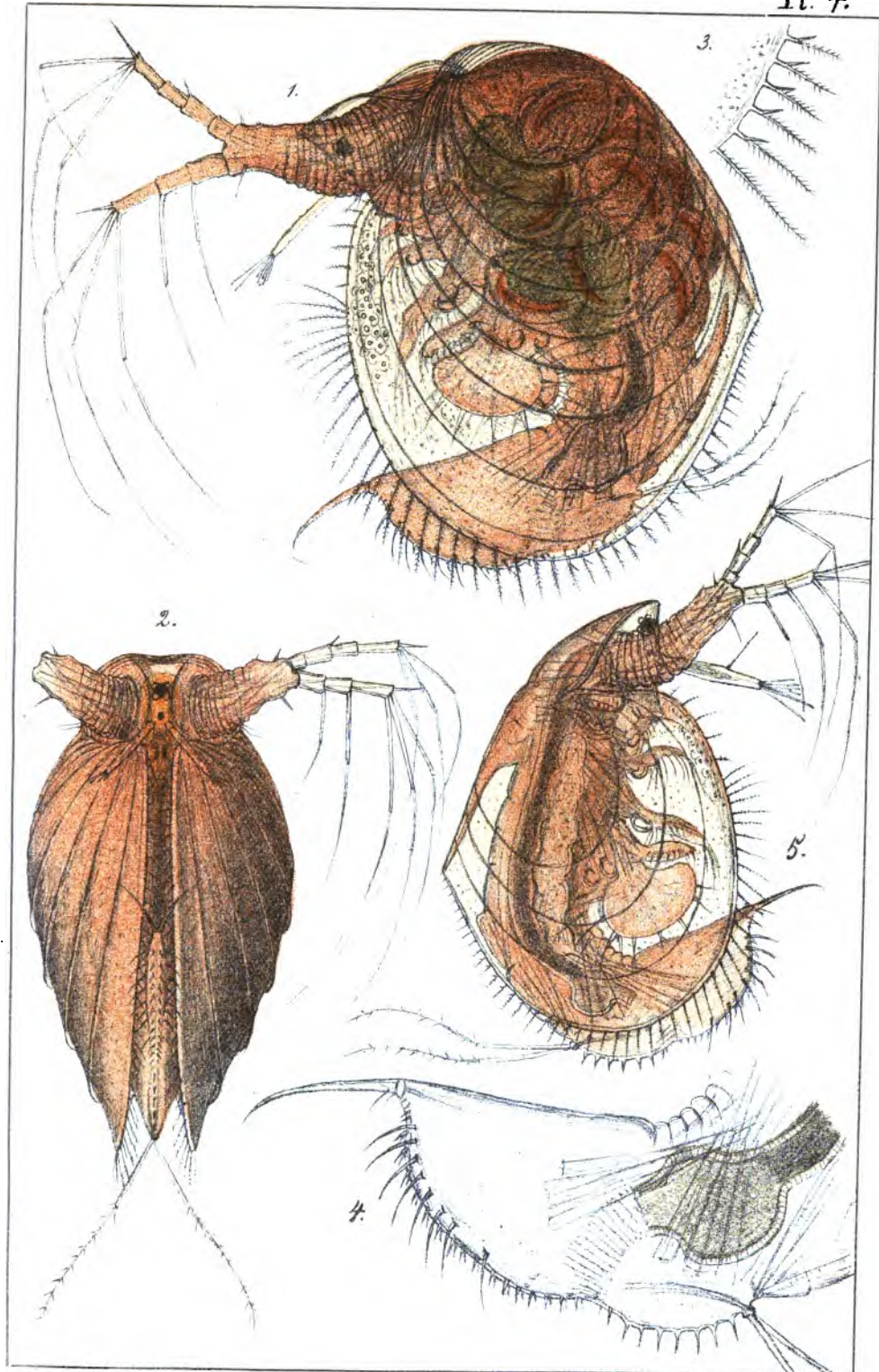
Fig. 6-7, " *Elizabetha*, (King).



G.O. Sars autogr.

Macrothrix spinosa, King.

M. Lynge, imh. J. A. Christensen
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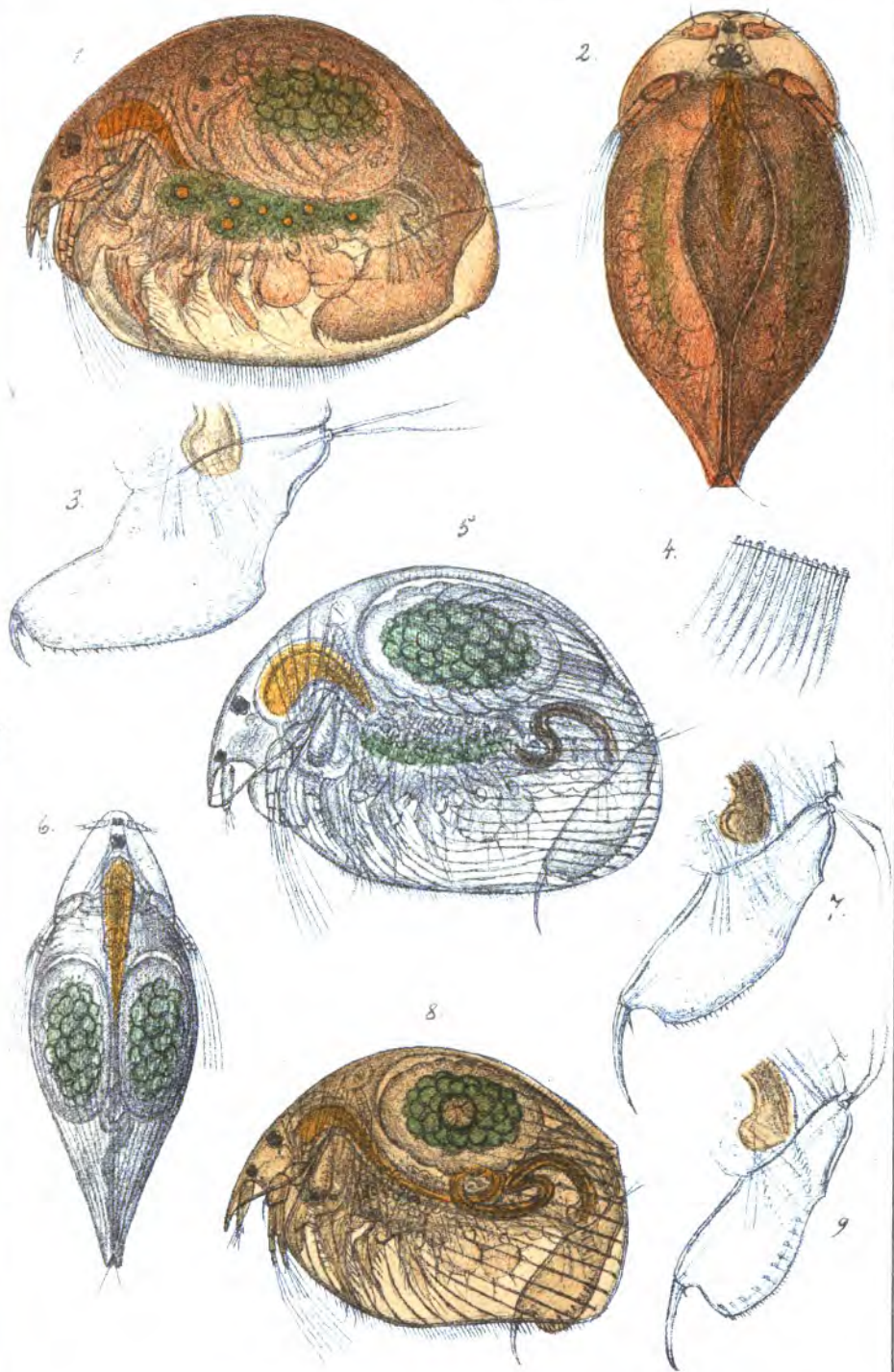


G.O. Sars autogr.

Ilyocryptus longiremis, n. sp.

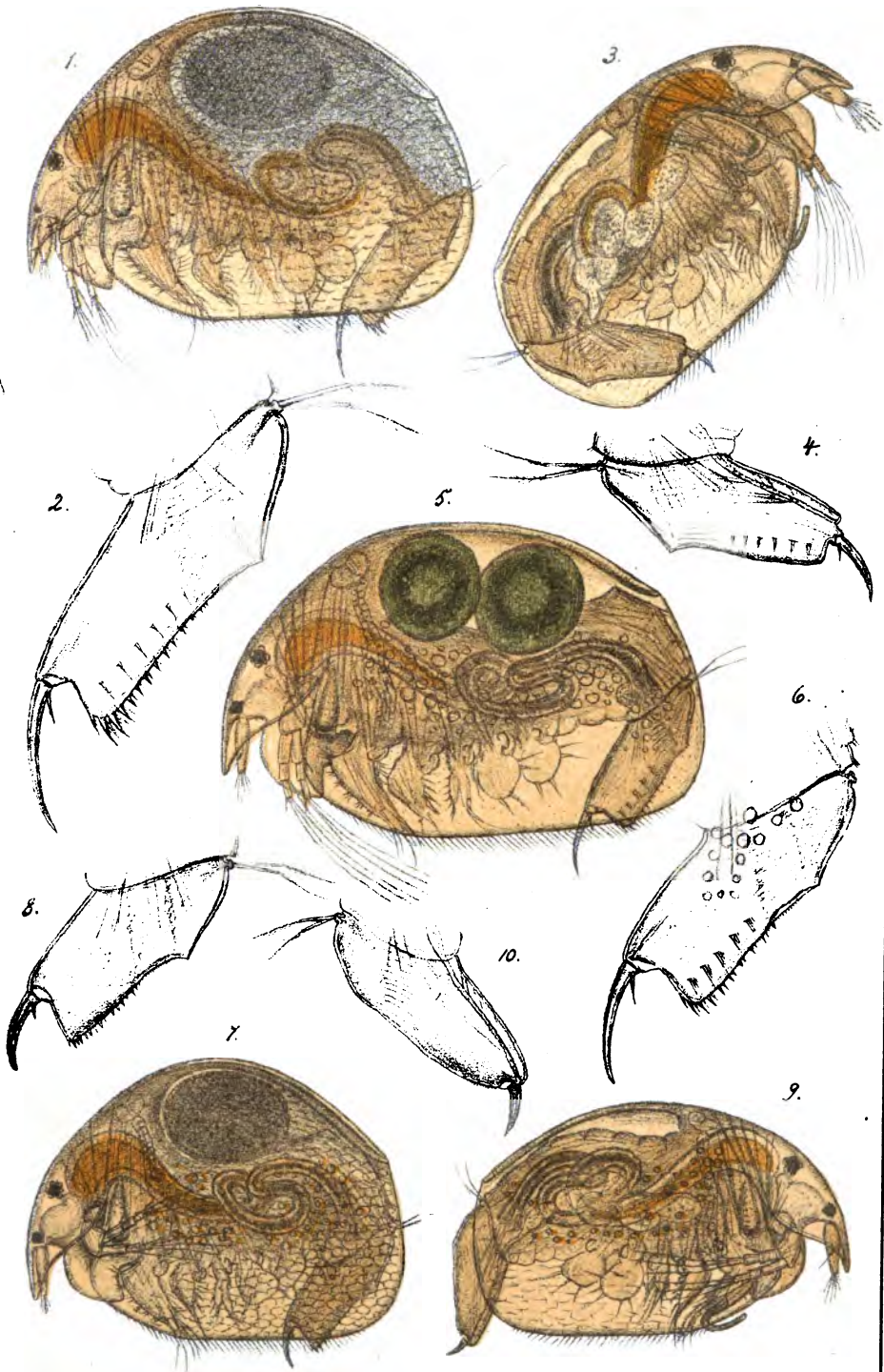
M. Nyman, Stockholm, 1888

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Fig. 1-4, *Dünhevedia crassa*, King.
 Fig. 5-7, *Alonella diaphana*, (King)
 Fig. 8-9, " *Karria*, (King).



G.O. Sars auct.

Fig. 1-4, *Alona Archeri*, n. sp. ♀ & ♂.
 Fig. 5-6, " *laevisima*, n. sp. ♀
 Fig. 7-10, " *clathrata*, n. sp. ♀ & ♂.

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